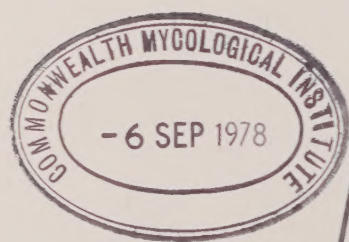


91/6
NEW SOUTH WALES DEPARTMENT OF AGRICULTURE
ANNUAL REPORT 1976-77





IF	
RPP	
RMVM	
BSM	

1976-77

NEW SOUTH WALES

REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE
Year ended 30 June, 1977

D. WEST, GOVERNMENT PRINTER, NEW SOUTH WALES—1978

G 38793K—1

Digitized by the Internet Archive
in 2025

ARRANGEMENT OF THE REPORT

ORGANIZATION CHART

SENIOR ADMINISTRATIVE PERSONNEL

The Hon. D. DAY, M.L.A.,

Minister for Decentralisation, Development and Primary Industries,
Sydney.

Sir,

I have the honour to present a report reviewing the activities of the Department of Agriculture for the year ended 30th June, 1977.

R. M. WATTS,

Director-General.

ARRANGEMENT OF THE REPORT

ORGANIZATION CHART

SENIOR ADMINISTRATIVE PERSONNEL

Section

- 1 THE RURAL INDUSTRIES OF NEW SOUTH WALES 1976-77
- 2 ADMINISTRATION
- 3 RESEARCH ACTIVITIES
- 4.1 EXTENSION ADMINISTRATION
- 4.2 PROGRAMMED EXTENSION ACTIVITIES
- 4.3 OTHER EXTENSION ACTIVITIES
- 5 EDUCATION
- 6.1 REGULATORY AND TECHNICAL SERVICES: PLANTS AND PLANT PRODUCTS
- 6.2 REGULATORY AND TECHNICAL SERVICES: ANIMALS AND ANIMAL PRODUCTS
- 6.3 MARKETING SERVICES AND SERVICES TO OTHER ORGANIZATIONS
- 6.4 GARDENS, DOMAINS AND PARKS

Appendices

- I ACCOUNTS OF THE DEPARTMENT FOR THE YEAR 1976-77
- II PUBLICATIONS 1976-77

ANNEXE: REPORT OF PRICKLY-PEAR DESTRUCTION COMMISSION

The objectives of the New South Wales Department of Agriculture are to safeguard and improve the productivity of the agricultural industries of New South Wales; and to encourage the orderly marketing of safe, acceptable produce, with consequent improvement in the prosperity and quality of life of both rural and urban communities. The main aim of this report is to enable the Minister to table in Parliament a comprehensive record of what the Department did to attain its objectives during the year under review.

This report is also distributed to libraries, industry leaders and others throughout Australia and overseas, usually on an exchange basis. It is not intended for a wide audience, which is catered for by other, more regular, publications.

CONTENTS

	Page
Organizational Chart	10
Senior Administrative Personnel	11
Section:	
1 RURAL INDUSTRIES OF N.S.W.	13
THE INDUSTRIES	13
Wheat	13
Oats	14
Rice	14
Barley	15
Sugar Cane	15
Maize	15
Grain Sorghum	15
Miscellaneous Cereals	16
Leguminous Crops	16
Cotton	17
Tobacco	18
Irrigation Review	18
Pastures	18
Fodder Conservation	21
Oilseed Crops	21
Vegetables	22
Citrus Fruits	24
Stone Fruits	26
Pome Fruits	27
Berries	28
Temperate Tree Nuts	28
Grapes	29
Tropical Fruit	30
Wool and Sheep Meat	31
Agricultural Machinery	33
Factors of Importance to a Number of Industries	33
Beef	34
Pigs	34
Poultry	35
Honey	35
Dairying	36
2 ADMINISTRATION	
Central Administration	39
Accounts	39
Office Accommodation	40
Committees, Councils and Trusts	41
Staff Statistics	42
Safety	43
Organization and Methods	43
Pesticides Registration Section	43
Marketing Boards and Polls	43
Legal Branch	44
Staff Development	45
DIVISION OF EXTENSION SERVICES	47
DIVISION OF ANIMAL INDUSTRY	49
DIVISION OF DAIRYING	53

CONTENTS—*continued*

Section	Page
DIVISION OF HORTICULTURE.. .. .	57
DIVISION OF PLANT INDUSTRY	59
BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE	61
BIOMETRICAL BRANCH	65
DIVISION OF MARKETING AND ECONOMICS	67
DIVISION OF RESEARCH SERVICES	69
ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM	73
AGRICULTURAL EDUCATION SECRETARIAT	75
 3 RESEARCH ACTIVITIES	 77
HORTICULTURE AND HORTICULTURAL PRODUCTS ..	77
Stone Fruits	77
Pome Fruits	78
Citrus Fruits	81
Tropical Fruits	83
Viticulture	84
Berry Fruits	86
Ornamentals	86
CROPS AND CROP PRODUCTS	87
Vegetables	87
Cotton	89
Oilseed Crops and Grain Legumes	90
Wheat Breeding	93
Wheat Quality	94
Wheat Production Agronomy	94
Wheat Disease	95
Oats and Barley	96
Maize and Sorghum	97
Rice	98
Pests of Stored Grains	99
PASTURES AND FORAGE CROPS	100
Pasture Establishment	100
Pasture Management	101
Pasture Plant Nutrition	102
Evaluation of Pasture Species and Forage Crops	103
Weeds of Pasture	104
Insect Pests of Pasture and Forage Crops	105
LIVESTOCK AND LIVESTOCK PRODUCTS	106
Sheep and Wool	106
Beef Cattle	109
Dairy Cattle Production	110
Dairy Products	111
Pigs	112
Poultry	113
Livestock Disorders	114
Cattle Tick Control	115
Mastitis	116
Goats	117

CONTENTS—continued

Section	Page
RESEARCH IN BIOLOGY AND CHEMISTRY	117
Noxious Animals	117
Systematics	118
Plant Ecology	119
Pesticide Chemistry	120
Water Quality	121
Plant Nutrition	122
Soil Bacteriology	123
Electron Microscopy	124
Soils	125
Soil Physics	125
BIOMETRICAL RESEARCH	126
AGRICULTURAL ENGINEERING	126
AGRICULTURAL MACHINERY	126
SOCIAL RESEARCH	127
Economics and Marketing	128
4.1 EXTENSION ADMINISTRATION	131
Extension Staff	131
New Developments	134
Support for Extension	136
4.2 PROGRAMMED EXTENSION ACTIVITIES	139
TABULATED SUMMARY	139
NATIONAL AND STATE OBJECTIVES	139
Grain Pest Campaign	139
Brucellosis in Cattle	140
Mastitis Control	140
Exotic Disease	140
Pesticide Residues	140
Livestock Marketing Report Service	141
Sheep Blowfly	141
Carcase Classification	141
Sheep Reproduction	142
Wool Clip Preparation	142
Sheep Handling	142
Objective Measurement	142
Drought Preparedness	142
Dairy Product Quality	143
REGIONAL OBJECTIVES	143
General Examples	143
Sheep Fertility	143
Clover-Induced Infertility	143
Control of Fruit-fly	144
Nematodes in Vines	144
School Leavers Entering Agriculture	144
Cattle Production Efficiency	144
Efficient Use of Fertilizer	145
Pastures	145
Hydatids	146
Australian National Field Days	146
Carpet Wool Production	146
DISTRICT OBJECTIVES	147
Ill-thrift in Coastal Cattle	147
Least Cost Pig Rations	147
Dairy Production—Lismore	147
Taree—Small Producers	147
Pasture Improvement/Stocking Rates	147
Rangeland Management in Arid Zones	148
INDIVIDUAL OFFICER OBJECTIVES	148
Solids-Non-Fat Levels in Milk	148
Irrigated Wheat	148
Honey Production	148
Weed Control in Cereals	149

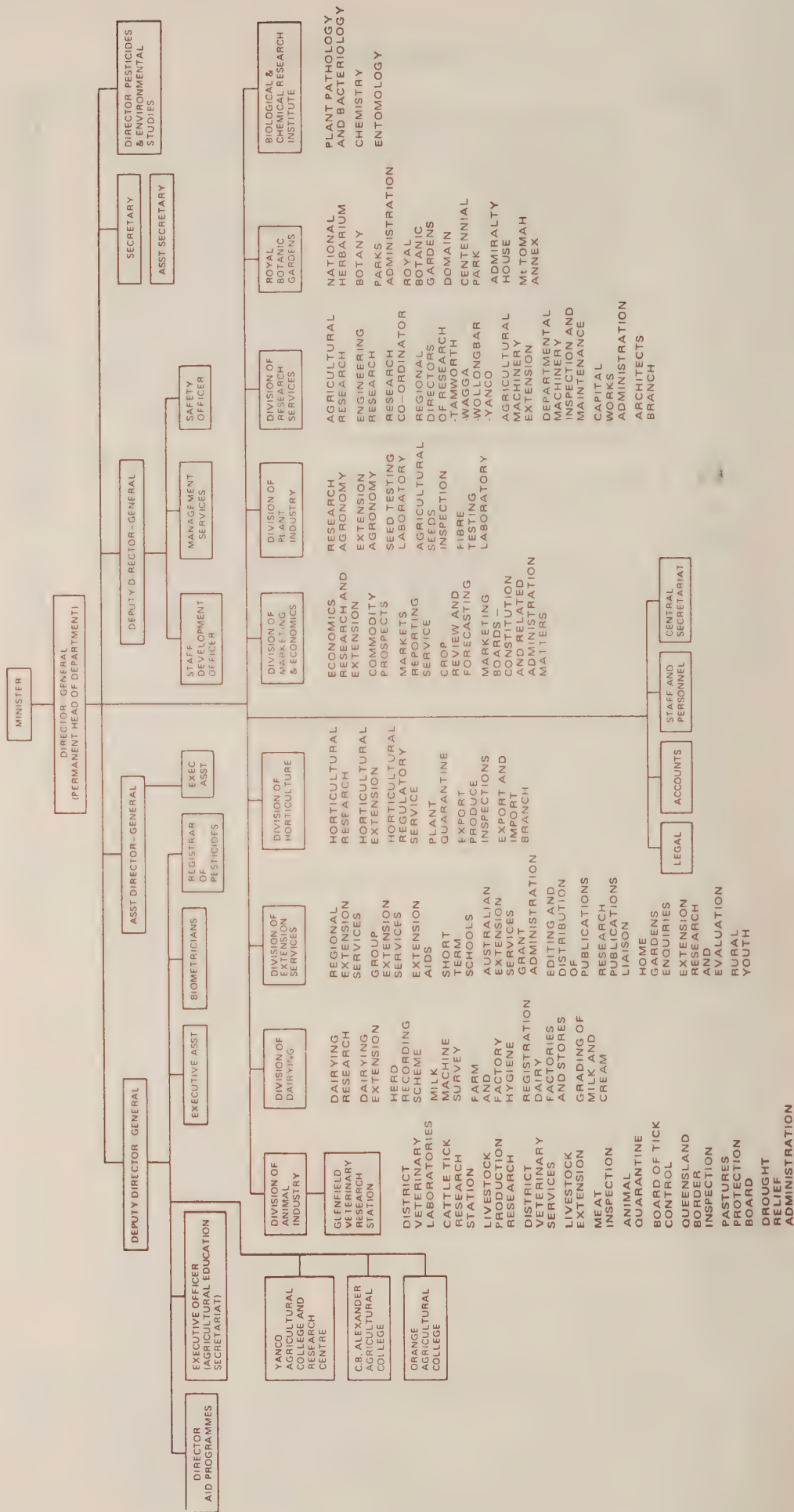
CONTENTS—continued

Section	Page
4.3 OTHER EXTENSION ACTIVITIES	151
AD HOC AND SPECIAL ACTIVITIES	151
LIAISON	151
Extension/Inter-State	151
Extension/Education	152
Extension/Research	152
Extension/Industry	152
SUMMARY OF INDIVIDUAL AND GROUP ACTIVITIES	153
SUMMARY OF MASS MEDIA OUTPUT	153
PUBLICATIONS	153
HOME GARDEN INQUIRIES	154
5 EDUCATION	155
New Administrative Arrangements	155
Educational Research	155
Capital Works Programmes	156
N.S.W. Institute of Rural Studies	156
COLLEGES OF ADVANCED EDUCATION	157
Courses	157
Student Enrolments	158
Short-term Schools	158
Farm Section	158
CERTIFICATE COLLEGES	158
Courses	158
Student Enrolments	159
Assisted Students	159
Farm Section	159
6.1 REGULATORY AND TECHNICAL SERVICES	160
Plant Diseases Act	160
Horticultural Stock and Nurseries Act	163
Potato Growers' Licensing Act	163
Quarantine Act (Commonwealth)	163
Customs and the Commerce (Trade Descriptions) Acts (Commonwealth)	166
Fertilizers Act	167
Pest Destroyers Act	167
Agricultural Seeds Act	167
Seed Production	168
Seed Testing	168
Seeds Laboratory	168
Noxious Plant Control	169
Analytical Services	169
Plant Health Diagnostic Services	170
Quality Assessment	170
Plant Disease Records	170
Botanical Services	170
6.2 REGULATORY AND TECHNICAL SERVICE: ANIMALS AND ANIMAL PRODUCTS	171
Regulatory Disease Control	171
Animal Health Diagnostic Services	175
Cattle Tick and Tick Fever Control	176

CONTENTS—*continued*

Section	Page
Queensland Border Control	178
The Dairy Industry	178
Animal Quarantine	179
Meat Inspection	180
Noxious Animals and Insects	181
Pesticide Residues	182
Miscellaneous Legislation	183
Apiculture	184
Miscellaneous Services.. .. .	184
 6.3 MARKETING SERVICES AND SERVICES TO OTHER ORGAN- IZATIONS	 187
Marketing Reports and Related Services, Price Reporting ..	187
Services to other Departments and Organizations	187
 6.4 GARDENS, DOMAINS AND PARKS	 189
Royal Botanic Gardens	189
 <i>Appendices</i>	
I Accounts of the Department of Agriculture for the year 1976-77	191
II Publications	199
Annexe—Report of the Prickly-pear Destruction Commission ..	225

Department of Agriculture N.S.W.



SENIOR ADMINISTRATIVE PERSONNEL

As at 30th June, 1977

Minister	..	..	..	..	..	Hon. D. DAY, M.L.A.
Director-General	..	..	..	..	..	R. M. WATTS
Deputy Director-General	..	..	..	..	..	B. OWEN FRENCH
Deputy Director-General	..	..	..	..	..	Dr R. B. DUN
Assistant Director-General	..	..	..	..	..	Dr K. P. SHERIDAN
Secretary	..	..	..	..	..	J. L. HAGER
Assistant Secretary	..	..	..	..	..	R. E. JONES
Accountant	..	..	..	..	..	D. A. SMITH

Chiefs of Divisions:

Animal Industry	..	..	..	..	..	D. H. MUMFORD
Dairying	..	..	..	..	..	Dr G. J. SMITH
Horticulture	..	..	..	..	..	G. R. GREGORY
Plant Industry	..	..	..	..	..	Dr S. G. GRIMMETT
Marketing and Economics	..	..	..	..	..	Dr D. E. MACCALLUM
Extension Services	..	..	..	..	..	J. N. POTTER
Research Services	..	..	..	..	..	K. E. HUTTON
Chief Biometrician	..	..	..	..	..	E. A. ROBERTS
Director of Pesticides and Environmental Studies	..	..	..	..	..	T. H. JOHNS

Biological and Chemical Research Institute Management Committee:

Chairman and Director of Entomology	..	..	..	..	..	M. CASIMIR
Director of Biology	..	..	..	..	..	Dr G. EVANS
Director of Chemistry	..	..	..	..	..	F. W. CRADOCK
Executive Officer	..	..	..	..	..	C. J. PARKER
Director and Chief Botanist, Royal Botanic Gardens and National Herbarium	..	..	..	..	..	Dr L. A. S. JOHNSON
Director, Aid Programmes	..	..	..	..	..	J. H. BALLARD
Executive Officer (Agricultural Education)	..	..	..	..	..	J. E. JESSUP

Principals, Agricultural Colleges:

C. B. Alexander Agricultural College	..	..	..	..	..	G. C. McFARLANE
Orange Agricultural College	..	..	..	..	..	R. J. NAPIER
Yanco Agricultural College	..	..	..	..	..	K. W. BANNISTER

1. THE RURAL INDUSTRIES OF N.S.W. 1976-77

WHEAT

Preliminary figures for the 1976-7 season indicate that about 5 141 000 tonnes was harvested from 3 116 000 hectares at an average yield of 1.65 t/ha. This production was the third highest on record, being exceeded only by the 1966-7 and 1968-9 seasons. Average yield is the best since the record year of 1966-7 and well above the 10-year average of 1.28 t/ha.

The high yields were quite remarkable considering the rainfall received during the growing period, particularly in southern areas where good rains received in July and October were substantially responsible for the high yields recorded. Yields would have been even higher had not the rain ceased suddenly in mid-November and been followed by very hot windy weather which prevented full grain development.

Diseases were not serious in 1976-7. Conditions did not suit *Septoria tritici* until late in the season while the cool spring prevented serious outbreaks of stem rust. In the northwest, yellow leaf spot (*Pyrenophora tritici-repentis*) appeared for the first time in two decades. Although crop yields were not greatly reduced, "pink grain" caused the downgrading of thousand of tonnes of wheat. Loose smut (*Ustilago nuda*) occurred throughout the State while ergot (*Claviceps purpurea*) appeared in some southern crops. Foot-rot (*Fusarium graminearum*) and take-all (*Gaeumannomyces graminis* var *tritici*) occurred in most areas of the State while the root rot (*Rhizoctonia solani*) appeared at Yass.

During winter, wheat root scarab larvae (*Anodontonyx noxius*) thinned out establishing wheat crops on parts of the Northern Tablelands and Slopes; cutworms (*Agrotis infusa*) damaged some newly sown crops in the Western Division and wireworms infested crops on the Southern Slopes. Armyworms (*Pseudaletia convecta*) occurred on roots of young wheat plants in the M.I.A. in May and June.

Harvesting was late in most areas. Hot, windy weather in early December caused shattering losses in some areas particularly in easy-stripping varieties such as Egret. Nearly everywhere grain was lower in moisture and protein content than usual.

Receivals

The official quality standards for the 1976-7 harvest were determined in February, 1977. They are set out in the following table, together with the approximate total receivals of each grade by the Australian Wheat Board.

Grade	Test Weight (kg/hl)	Approx. Receivals (000 tonnes)
Prime Hard No. 1 (14 per cent min. protein)	79.5	52
Prime Hard No. 2 (13 per cent min. protein)	79.5	565
Prime Hard Varieties (12-13 per cent protein)	—	275
Australian Hard N.S.W. Northern No. 1 ..	80.0	404
Australian Hard N.S.W. Northern No. 2 ..	79.2	782
Australian Hard N.S.W. South Western ..	79.5	156
Australian Standard White	78.5	1 576
Australian Standard White (Soft Varieties) ..	79.3	47
General Purpose	76.0	450
General Purpose No. 1	—	81
Mill Prime Soft	—	59
Mill Prime Hard	—	4
Duramba	—	5
Total		4 456

Features of the harvest were:

- a generally lower level of protein compared with the previous season, due to the rapid finish to the season.
- Extremely low moisture content of grain (mostly around 9 per cent).

Industry Developments

New wheat varieties, particularly the semidwarfs Condo and Egret, met with increasing acceptance by growers. Although Timgalen remained the most popular variety in New South Wales, Condo accounted for 28 per cent of wheat delivered in 1976-7, becoming the second most popular variety, only three seasons after its introduction. A similar trend is foreshadowed for Egret, following its recommendation for dryland sowings in some southern areas of the State. The success of these varieties and their stimulus to the New South Wales and national wheat industries must be regarded

as one of the most significant contributions made to primary industry by the Department. A newly registered variety, Shortim, a dwarf with semiwinter to winter habit, good disease resistance and grain of Prime Hard Quality is expected to be grown on a large area in the northwest for early to mid-season sowing.

Whilst there has been a marked improvement in wheat varieties, production technology and mechanization, the wheatgrowing industry is faced with rapidly increasing costs of production. The buoyant wheat prices of the past three seasons have enabled wheat to maintain its position as a major contributor to farm income. However, should there be a decline in prices, serious consequences would soon become apparent. Similarly, newly released high yielding wheats are prone to lower grain protein content, particularly where these varieties are grown on soils of lower fertility. Consequently, amendments are proposed to receival and recommendation procedures, to confine wheat varieties to areas where their yield and quality will best equate to local environmental conditions.

Although the 1976-7 wheat crop was the third largest produced, protracted delays occurred in the handling and shipping of grain due to industrial disputes.

OATS

The estimated oat production 1976-7 was 312 000 t compared with 350 000 t produced last year. The area harvested for grain was 251 000 ha and the average yield was 1.24 t/ha, the highest since 1966-7. Total sowing for all purposes was estimated at 480 000 ha. Early sowing of oats for grazing was severely curtailed by dry weather which interfered with land preparation and sowing. Most sowings were carried out very late (late June-early July) and little grazing was possible. Fortunately, the spring was favourable with adequate rainfall, mild temperatures and low disease incidence.

Cooba, the leading variety since 1965-6, occupied 40.5 per cent of the total area in 1975-6, the latest season for which figures are available. This was slightly less than the peak of 42 per cent attained by Cooba the previous season. Coolabah maintained its position in second place with 20 per cent, a slight decrease over the previous season. Avon maintained its fourth position but continued its long-term decrease in popularity—mainly due to its losses from stem rust. Most other varieties included in the variety census showed little change in percentage area.

About 10 000 t of oat grain was received by the Oat Marketing Board for sale on domestic and overseas markets.

Loose smut (*Ustilago avenae*) occurred throughout the State; barley yellow dwarf virus occurred in southern areas while stem rust (*Puccinia graminis* f. sp. *avenae*) occurred in the northwest.

Nickel toxicity occurred again in crops in the Cootamundra district with samples containing up to 71 ppm of nickel.

RICE

A record 518 000 t of paddy was harvested from 89 409 ha being 25 per cent above the previous record of 1975-6. The proportions of the total area harvested were 24 per cent in the Coleambally Irrigation Area, 37 per cent in the Murray Valley and 39 per cent in the Murrumbidgee Irrigation Areas. Rice receivals were Calrose 55 per cent and Inga 33 per cent, with smaller percentages for the other commercial varieties. Individual farm allocations were increased for the season to 73 ha, to satisfy demands for the medium grain Calrose on overseas markets. Growers in the Coleambally and Murrumbidgee Irrigation Areas were able to take advantage of the increased area. Few problems were experienced with the demand for increased water supply for the large crop.

The first advance rate per t was \$58 for Calrose, \$64 for Caloro and Kulu and \$80 for Inga. The second advance per t has been proposed at \$13 for Calrose, \$15 for Caloro and Kulu and \$24 for Inga. Calrose was the base price variety with 20 per cent variety premiums for the other varieties. Farmers were delighted with the harvest, quoting Inga yields of up to 7 t/ha and Calrose up to 9 t/ha. Early sown crops gave the best yields.

Spraying for barnyard grass, *Echinochloa crus-galli* and dirty dora, *Cyperus difformis*, increased, particularly in southern rice areas. An unusually prolonged cold beginning to the season may have been the reason for more infestations of star fruit, *Damasonium minor*, than normal.

Bloodworm (*Chronomus tepperi*) infestations were lower compared with recent years but control measures were still needed to prevent major losses. While significant damage occurred, leafminer (*Hydrellia* sp.) and aquatic snails (*Physastra* spp.) infestations were less than last year.

BARLEY

The 1976-7 barley production was estimated at 549 000 t from 404 000 ha with an average yield of 1.35 t/ha. The estimated area sown for all purposes was 430 000 ha. Both grain production and area were the second highest for New South Wales being exceeded only in 1975-6.

Clipper, the leading variety for the past five seasons, was grown on 47.0 per cent of the total area in 1975-6 compared with 40.8 per cent the previous season. Abyssinian remained in second place with a percentage area of 14.3 per cent, a fall from 16.6 per cent during the previous season. Other varieties recorded less than 10 per cent of the percentage area and showed little change compared with the previous season.

About 325 000 t of grain were delivered to the Barley Marketing Board for marketing on the domestic and export markets. Smut in barley crops caused a significant number of rejections of grain at receival centres.

Both loose smut (*Ustilago nuda*) and covered smut (*U. nuda*) occurred in most districts, with loose smut causing some yield losses.

SUGAR

Sugarcane was harvested from 23 300 ha in 1975-6 and was crushed at CSR Ltd's Condong, Broadwater and Harwood Mills. Raw sugar tonnage (94 n.f.) was 103 962 valued at \$21,216,002.

MAIZE

Maize production was estimated at 80 000 t from 30 000 ha. The first volunteer pool was formed by the Yellow Maize Marketing Board, which arranged receival at Pinkenba near Brisbane at \$70/t first advance rate. North Coast growers supported the pool, and good quality grain was received although the tonnage received by 30th June, 1977, was below expectation.

The Sydney market price for new season grain was \$97 in January but weakened to \$94 in June.

Wet weather and gale force winds flattened large areas of ripe maize, delaying the harvest. This delay resulted in serious weevil damage on the coast but inland crops harvested grain of excellent quality. Stalk rots, cob rots and rusts were common in coastal crops but northern leaf blight (*Drechslera turcica*) infection was light yet fully susceptible hybrids were still damaged.

Wireworms thinned out newly sown crops in the southwest; *Monolepta* beetles (*Monolepta australis*) damaged silking crops on the North Coast and migratory locusts (*Locusta migratoria*) damaged mature crops in the northwest.

Popular hybrids were XL81, DK805a, XL45, XL361, GH128 and GH390. Small areas were sown to MH630, MH633 and Pride of Australia.

GRAIN SORGHUM

In 1976-7 production was estimated at 330 000 t from 155 000 ha compared with a production of 376 000 t from 160 000 ha in 1975-6.

Severe moisture stress during December/January in the Namoi Valley and till late February in the Gwydir Valley markedly reduced dryland yields. Irrigation crops were continually watered during the dry summer. Continual wet and overcast weather and associated flooding in northern New South Wales seriously delayed harvesting many crops until late June. The grain quality deteriorated with lower grain densities, increased cracking and high moisture content in both dryland and irrigated crops.

Most of the lower quality grain was sold on the domestic market at prices of \$65 to \$70 per t "on farm". The Grain Sorghum Marketing Board paid \$67 per t first advanced with an expected total pool payment of about \$80 per t less individual freight. As at 30th June, the Board had received only 96 000 t and had been notified of only 6 580 t sold to licensed merchants.

Sorghum midge (*Contarinia sorghicola*) remained the most important pest of sorghum, often requiring 2 to 4 sprays on late-sown crops. Infestations of heliothis (*Heliothis armigera*) were generally light.

Periconia root-rot (*Periconia circinata*) and "crazy top" (*Phytophthora macrospora*) occurred in the northwest following the late February/March rains.

Following successful seed production, the Dekalb hybrid E57 regained most of its popularity.

MISCELLANEOUS CEREALS

Forage Sorghum and Other Forage Crops

An estimated 21 120 ha was sown to forage sorghums in 1976-7. This was an increase of about 10 per cent above the area sown in 1975-6, and a result of poor pasture recovery in late spring and early summer in southern and western parts of the State. The area sown to broad-leaf forage crops was increased by 30 per cent above 1975-6 to about 10 400 ha for 1976-7. Most of the increase resulted from the sowing of lablab (in northern parts of the State) and fodder turnips (6 000 ha).

Broom Millet

About 400 t of fibre was produced in 1976-7 from 450 ha. In the Tumut district, 350 t of good quality fibre was produced. The North Coast crop produced some weather damaged fibre but generally the crop was of good quality. About \$800 per short ton (907 kg) was paid for early packed bales. Some Dwarf Tan fibre was processed but was found to be less suitable than the popular variety of selected White Italian.

Sweet Corn

An estimated 19 000 t of fresh sweet corn was harvested from 2 200 ha in 1976-7. About 1 950 ha was grown for processing at Bathurst, Cowra, Dubbo, Forbes, Windsor and Tumut. The remaining area supplied the Sydney and other fresh markets.

Processors preferred the variety Stylepak, with some areas sown to Iochief and NK195. Some fresh market suppliers grew small areas of Terrific for early crop and Golden Champion for main crop but main sowings were of Iochief.

Popcorn

The popcorn harvest was estimated at 150 t, being produced at Mudgee and Spring Ridge. The variety 510 P was mainly grown for the local popcorn confectionery market. Overseas interest was strong in supplies of popcorn for the Japanese and other eastern markets.

Grain Millets

About 1 000 ha was sown to grain millets in 1976-7. Yields ranged from 0.5 to 2 t/ha and prices varied from \$150 to \$250/t. The demand was firm for Hungarian, Panorama, Panicum, White French, Shirohie and Japanese seed of good quality.

Canary Seed

The canary seed harvest yielded an estimated 1 000 t from 1 500 ha in 1976-7. Prices varied from \$295 to \$350/t for good quality seed.

Rye

The latest available statistics show 4 636 ha sown for all purposes in 1975-6, well above the area of 4 151 ha sown during the previous season. Grain production was 2 010 t (about double the production in 1974-5) from a harvested area of 2 675 ha (compared with 1 765 ha in 1974-5), giving an average yield of 0.75 t/ha, well above that of 0.61 t/ha attained the previous season.

Buckwheat

The estimated production was 1 200 t from 1 500 ha (in 1975-6 800 t from 1 000 ha). Sowings were made primarily on the tablelands and were reduced by dry conditions during December, the main sowing month. Best results were obtained from January sowings as these benefited from late summer/early autumn rain. Harvesting was mostly completed during May and weed growth was troublesome on old cultivation land.

GRAIN LEGUMES

Lupins

About 800 ha produced 1 000 t of grain in 1976-7. Most of the grain was kept for sowing for the 1977-8 season and the remainder was farmed to pigs or milled for stock feed. An estimated 10 000 ha was sown in autumn 1977 following a forward market contract price of \$100/t offered to growers.

Brown leaf spot (*Pheiochaeta setosa*) was widespread in the central west while damping-off occurred in some seedling crops.

Mung Beans

A record area of about 7 500 ha produced 4 000 t of beans in 1976-7. Prices to farmers ranged from \$220 to \$360/t, depending on quality and variety. The variety Regur produced better than others on heavier soil types. Celera stood up better to wet

weather at harvest but late sown Berken beans were split, shot and discoloured. Many grain parcels were contaminated with common mung beans and off-type beans. Difficulty was experienced in obtaining supplies of seed true to variety.

Green vegetable bug (*Nazara viridula*) and *Heliothis* spp. caused widespread damage in the northwest.

Cowpeas

Only 350 t was produced in 1976-7 because of the dry spring which delayed sowing and the wet summer which resulted in the development of powdery mildew. The new variety, Red Caloona, was found to be susceptible to *Cercospora* leaf spot. Prices were firm ranging from \$220 to \$350/t but regular supplies will be needed to retain markets.

Field Peas

About 200 t was produced from 170 ha in 1976-7. Field pea prices were firm, Dun peas were sold at from \$220 to \$350/t and Maples were scarce and brought up to \$350/t. There has been a heavy demand for seed, and small areas have been sown throughout the wheat belt.

Peanuts

Almost 250 ha was sown under irrigation at Wee Waa and a very small area at Alstonville on the North Coast under rain grown conditions. 1975-6, total area was 200 ha. Main varieties grown were the Virginia Bunch and Red Spanish. Yields from Virginia Bunch were most satisfactory, up to 5 t/ha.

COTTON

Cotton production was estimated at 93 000 bales of raw cotton from 25 000 ha (1975-6 season recorded 90 516 bales from 23 860 ha, or 3.77 bales/ha). In early February, the crop potential was 120 000 bales. The production prospects of the Namoi Valley were reduced by over 20 000 bales as a result of moderate flooding and associated waterlogging in late February/early March, severe hail storms, particularly in late January, and further moderate flooding and considerable weather damage in mid-May. In the Macquarie Valley, yield potential was reduced by hail damage late October, mid-November and mid-summer and significant weather damage in late May/early June.

Cotton—Estimated District Areas and Production for 1976-7

District			Area ha	Production bales	Average Yield bales/ha
Namoi Valley	..	..	17 000	65 000	3.82
Macquarie Valley	..	..	6 500	23 500	3.62
Bourke/Brewarrina	..	..	970	2 500	2.58
Moree	..	..	480	2 200	4.58
Total	..	..	24 950	93 200	3.73

In spite of cold, wet conditions which delayed planting, over 80 per cent of the crop was sown by the end of October. Although Deltapine 16 was the principal variety, the area sown to the longer stapled variety Namcala increased.

Harvesting commenced in late April but was delayed from mid-May until early June. In the Namoi Valley, lint quality reflected the unfavourable growing conditions from late February. Grades have been predominantly in the range strict low middling to middling with some middling plus. First pick micronaire mostly has been between 3.2 and 4.0. A high proportion of low micronaire cotton, reflecting fibre immaturity, is expected.

Seasonal conditions in the Macquarie and Gwydir Valleys were more conducive to better quality, colour and grades.

Insect activity throughout the season was generally low to moderate. Thrips (*Thrips tabaci*), aphids (*aphis gossypii*) and jassids (*Austroasca* spp.) were active during seedling growth. *Heliothis* spp. continue to be the major pests of cotton although their seasonal abundance (as indicated by light-trap catches) in total this season was only 32 per cent of the 1975-6 figures and 27 per cent of the 1974-5 figures.

Spider mite (*Tetranychus* spp.) infestations were significant in the Macquarie Valley and, to a lesser extent, in the Namoi Valley.

Seedling diseases were often significant due to low soil temperatures and wet conditions which were terminated by a sharp increase in late spring temperatures. Boll rots, bacterial blight and Verticillium wilt were encountered in association with excessive rain in late February/early March and again in mid-May in the Namoi Valley. The variety Namcala performed much better than the variety Deltapine 16 in heavily infested Verticillium soils whereas the reserve occurred with bacterial blight.

TOBACCO

The estimated production of 1 400 000 kg of leaf was obtained from 937 ha (in 1975-6, 1 047 500 kg of leaf was harvested from 861 ha). Northern New South Wales produces approximately 90 per cent of all New South Wales leaf. In the 1976 season, 1 146 000 kg of leaf was sold for a total value of almost \$3.9 million, an average price of 338.5 cents/kg. The 1976 Australian average reserve price was 347 cents/kg. Due to flood losses the majority of new and carryover leaf was sold during the 1976 selling season. Over quota leaf from the 1977 harvest will be stored by growers for sale in subsequent seasons.

Conditions were generally favourable during the growing period although hail damage reduced yield on a small number of the northern New South Wales crops. The principal varieties grown were NC 2326 and Hicks Q46. Harvesting was completed early in May and overall leaf quality was most satisfactory.

IRRIGATION REVIEW

The total irrigated area in New South Wales for the 1975-6 season (most recent statistics) was 603 000 ha compared with 555 000 ha in 1974-5. Over 80 per cent was irrigated by flood or furrow methods.

The areas of irrigated pastures and lucerne declined slightly but still remained the major users of irrigation land with 53 per cent of the total area irrigated.

Of major significance was the increased area devoted to irrigated wheat. There was a 151 per cent increase from the 30 100 ha sown in 1974-5.

The applications for financial assistance under the Farm Water Supplies Act were slightly fewer, with 184 compared with 193 in 1974-5. Nearly 80 per cent of the applications were for sprinkler systems. Interest in the centre pivot system of sprinkler irrigation has increased with the introduction of two more manufacturers.

A further three tube-well pumps were installed by the Water Resources Commission in the east of the Berriquin Irrigation District to alleviate the high underground water table.

Floods had a significant effect on production from irrigated farms in the Forbes-Condobolin sector of the Lachlan Valley. However, the new flood ways and other improvements in the Narrabri-Wee Waa area considerably lessened the impact of the flooding on the Namoi River.

Interest in redeveloping inefficient surface layouts is high but the cost of changing grades has significantly affected adoption in the South Western Region.

PASTURES

The Economic Climate for Pasture Improvement

The decline in the area of sown pastures primarily reflects the advantages of cash cropping and the depression in the beef industry. The increase in superphosphate purchases, aerial topdressing and sowing, and increased seed sales in the last quarter of the year indicate improved confidence in those industries dependant upon productive pastures. Poor market opportunities for beef caused many producers to withhold stock, adding to grazing pressure. However, producers have realized that a decline in pasture productivity through not topdressing will compound their difficulties. Generally, the good spring, summer and autumn rains have helped maintain a heavy grazing pressure but in the southwest hay reserves have been severely depleted and good winter and spring rains are needed to ensure sustained pasture recovery after the drought and locust ravages.

The arrival of the spotted alfalfa aphid and the blue-green lucerne aphid is a serious threat to the pastoral industry and indirectly to crop production because of our dependence on legumes for soil nitrogen. Until resistant lucerne varieties become available and biological control is effected, a period of great difficulty confronts the industry.

Natural Pastures

The 15 000 000 ha of natural pastures remain one of the State's major grazing resources. Most of these areas after good spring, summer and early autumn rains produced a large quantity of feed, ensuring a good carryover for the winter. However, in the southwest, pastures were adversely affected by drought and in some instances locusts as well. The late autumn rains brought some improvement to this area but good winter-spring rains are needed to ensure recovery.

Improved Natural Pastures

Improved natural pastures that contain adapted pasture legumes have carried a heavy concentration of beef cattle in both coastal upland and inland districts. A downturn in the amount of superphosphate topdressed on to improved natural pastures was associated with a decline in the legume content. With a recent significant increase in the amount of fertilizer used, this deterioration in pasture quality will be halted.

Sown Pastures

The area of sown pasture declined marginally by 2 per cent from the record in 1974-5 to 5 835 000 ha. This decline reflects an increase in the area sown to cash crops.

Pasture cockchafer larvae (*Aphodius tasmaniae*) caused widespread damage to native and improved pastures on the Southern Tablelands, during autumn and winter, 1976. Heavy beetle swarming occurred during late summer and subsequently many autumn sown and established pastures were again seriously damaged by pasture cockchafer grubs. Native and improved pastures on sections of the Central Tablelands were also heavily infested by larvae in autumn 1977.

Field crickets (*Teleogryllus* spp.) caused widespread damage to newly sown and established pastures on the Northern Tablelands, Slopes and Plains and in the Hunter Valley during summer and autumn.

Wingless grasshopper (*Phaulacridium vittatum*) and yellow winged locust (*Gastrimargus musicus*) damaged pastures on parts of the Northern, Central and Southern Tablelands during summer.

On subterranean clover, rust (*Uromyces trifolii-repentis*) and subterranean clover stunt virus were common during spring, especially on the Tablelands and in the central west. Subterranean clover red leaf virus was again widespread in coastal plantings during late spring.

On white clover, rust was severe during winter in the Hunter Valley where downy mildew (*Peronospora trifolii*) was also common during spring. Outbreaks of rugose leaf curl virus occurred in coastal and inland irrigated pastures.

Rye grass pastures became heavily infected with rust during early summer on the North Coast.

Lucerne

The area of pure lucerne declined from 620 000 ha in 1975-6 to 534 000 ha in 1976-7. Offsetting this, lucerne has again been increasingly used with perennial grasses to reduce the risk of cattle bloat, and as an additional component with subterranean clovers and annual medics in wheat belt pastures.

The recent arrival of two exotic pests of lucerne, the spotted alfalfa aphid (SAA) (*Therioaphis trifolii*) and the blue-green lucerne aphid (BGLA) (*Acyrtosiphon kondoi*) has caused a dramatic decline in new lucerne sowings.

The SAA was detected for the first time in New South Wales during April. It caused massive damage over wide areas during late autumn. All the major lucerne growing areas were infested but the worst affected areas were the Hunter Valley and central west. Often lucerne crops were completely defoliated and in some cases destroyed. Insecticides were widely used, particularly in irrigated lucerne. SAA eliminated the lucerne component of pastures in the Hunter Valley and other areas, resulting in substantial reduction in milk production. Medics were also affected.

The BGLA was not detected until early June. By July, it had been detected in most lucerne growing areas of the State from the Queensland border south to Bega. Damage was less severe than that of SAA but many crops were severely debilitated. White clovers were also attacked, particularly in the Hunter Valley.

The major diseases of lucerne were root rot caused by *Phytophthora megasperma*, common leaf spot (*Pseudopeziza medicaginis*) and *Rhizoctonia* sp. which infected undersown crops at Cootamundra causing stem and crown dieback.

Irrigated Pastures

High costs of irrigation water and economic factors continued to cause irrigators to maintain strong interest in cash crop production in spite of heavy stocking pressure due to carryover of beef cattle. Nevertheless, irrigated annual pastures remain an integral part of the soil fertility maintenance system for crop production, notably for rice, in southern districts. The area of irrigated pastures and lucerne declined only marginally, by two per cent, to 321 000 ha in 1976–7.

Pasture Decline

Gradual decline in pasture productivity despite continued use of superphosphate on the Central and Southern Tablelands has been associated with increasing soil acidity. Lucerne and subterranean clover pastures have been affected by induced aluminium and manganese toxicities which may be alleviated by topdressing with lime. The continual topdressing each year with superphosphate has been indirectly linked with the problem.

Aerial Pasture Improvement

Aerial pasture improvement early in the year continued to suffer severe reverses. The quantity of superphosphate applied fell to a meagre 50 000 t in 1976. An encouraging reversal of this trend occurred with a 70 per cent increase in the amount of superphosphate used for this purpose in autumn 1977.

Fertilizer Application to Pastures and Lucerne

The low liquidity and the cost/price squeeze caused a marked reduction in the amount of fertilizer used on pastures until March, 1977. Only 19 per cent of sown pastures and 10 per cent of lucerne were topdressed. A careful re-appraisal has continued of the actual needs for phosphorus, sulphur, molybdenum and other fertilizer elements. However, since March the decline in the use of superphosphate has ceased, with a substantial increase of 70 per cent in the amount of fertilizer used on pastures. The use of nitrogenous fertilizers on pastures continued the downward trend, except for special purpose forage production in coastal districts.

New Pasture Plants

The new subterranean clover varieties Seaton Park and Daliak which are low oestrogenic replacements for Dwalganup, were sown widely in the southern wheat belt. Seaton Park has also become an important variety in those areas of the central slopes where the persistence of Woogenellup is unsatisfactory. The first farm sowings were also made in the southern wheat belt of Trikkala, the recently released replacement for Yarloop on soils that become waterlogged. Apart from its low oestrogen content, Trikkala has the added advantage that it is less susceptible to the disease clover scorch.

Haifa white clover is now well accepted commercially in coastal, tablelands and inland irrigated pastures as a new dry-summer-tolerant white clover. There is a strong demand for its seed. Namoi Woolly Pod vetch is being widely grown as a pioneer bloat-safe legume; it has done well at Inverell, Yass and Cooma. There is a need for caution in the growing of Namoi Woolly Pod vetch in that wheat containing more than 30 vetch seeds per litre is subject to dockage.

Sirosa and Sirocco phalaris continued to give good results; however, high seed prices and seed shortage discourage wider use. Tetraploid ryegrasses have again given good winter feed in coastal districts when fertilized with nitrogen and when grown with Clare subterranean clover sown at a high seeding rate.

Pasture Seed Production

Because of poor market prospects and adverse seasonal conditions, overall production was low.

Production of certified seed was 765 t (685 t in 1975–6)—for details *see* section 6.1 Seed Production. Uncertified seed processed by seed cleaning firms during the year totalled 802 t (777 t in 1975–6) and included lucerne (227 t), Wimmera ryegrass (165 t), subterranean clover (143 t), carpet grass (114 t), paspalum (66 t). Clover scorch disease (*Kabatiella caulivora*) again depressed subterranean clover seed production in the south.

Year end demand for Hunter River lucerne seed ceased due to the devastation caused by the spotted alfalfa aphid on Hunter River lucerne stands. The importation of seed of resistant lucerne varieties from the United States has been encouraged. The potential production risks associated with blue-green lucerne aphid infestations on lucerne, subterranean clover and white clover seed is of concern to the industry.

Due to scarcity, seed prices have risen and it is expected that production will be stimulated.

FODDER CONSERVATION

Hay

The estimated tonnages of hay production in 1976-77 were: wheat, 57 000 t; oats, 73 000 t; barley, 6 600 t; pastures, 250 000 t and lucerne, 400 000 t. Total: 786 600 t. Lucerne hay production fell by over 10 per cent as the dry early summer restricted lucerne recovery from the dry winter. The late, wet summer limited opportunities to make high quality hay. Pasture hay production was affected by the dry early summer and wet autumn on the Central and Southern Tablelands where most of the improved pastures are located.

Winter cereal hay production was up by about 20 per cent as farmers tried to replenish some of the stock fodder reserves used up in the hard winter in southern and central parts of the State.

Silage

Limited tonnages of silage were made and no estimate can be given. Most crops intended for silage were fed as green chop. Maize for green chop and silage were down to 2 900 ha, a decrease of 25 per cent and millet set aside for grazing, which occupied 2 000 ha, gave only moderate production because of the dry early summer.

Grain

On farm grain was estimated for wheat at 284 500 t; oats, 392 034 t; barley, 127 062 t and other cereals, 7 900 t for 1976-7. Generally on farm storage was down for all grains by 2 per cent for wheat, 6 per cent for oats, 4 per cent for barley and 30 per cent for other cereals. Good grain prices resulted in a higher proportion of grain sold and less grain fed to livestock.

OILSEED CROPS

Linseed

Sowings were estimated at 5 000 ha and production at 4 500 t, an average yield of 0.9 t/ha (6 756 ha and 5 514 t, i.e., 0.81 t/ha in 1975-6). Over 90 per cent was sown in the Western and New England Regions, i.e., primarily in premium wheat growing districts. Varieties grown were Glenelg, the major variety, and Bonnydoon.

Most sowings were made from late June to late July, about one month later than normal. Favourable weather prevailed from sowing until early November, so that the majority of crops had high yield potentials.

Rapeseed

Area and production were estimated at 500 ha and 400 t respectively (3 957 ha and 3 107 t in 1975-6). Varieties grown were Midas, the major variety, and Tower. Dry autumn conditions delayed most of the slopes sowings until late June/July. Despite above average rainfall from sowing until early November, yields were retarded by the late sowings. On the tablelands, yields of the few spring-sown crops were reduced by the dry late spring.

Safflower

The estimated 4 000 ha sown produced 2 000 t (6 825 ha and 2 291 t in 1975-6). Safflower production was concentrated in three production districts, the Western Division where about 2 000 ha was sown along the Darling River following autumn flooding, the Coonamble district and the Moree district. Crops were sown in the Wilcannia/Tilpa areas from mid-June until the end of October, with most other sowings in late July and August. Seasonal conditions favoured crop development to mid-November, with yields related to the time of sowing and the moisture available from mid-November until late December.

The disease, *Alternaria carthami*, was widespread in crops in the central west.

Sunflowers

The area sown was estimated at 39 000 ha with production of 17 000 t (62 567 ha and 32 589 t in 1975-6). Over 50 per cent of the crop was sown in the North Western Slopes and Plains and Central Northern Slopes. About 10 per cent of the area was irrigated, primarily in the Riverina and Macquarie Valley.

Spring and early summer dryland sowings were restricted by dry conditions. Late summer sowings were affected by excessive rainfall in the northwest from the end of February. The majority of irrigated crops experienced favourable conditions and were harvested under good conditions. Harvest of late sown crops was delayed by adverse weather.

Seed shortages considerably reduced the anticipated area. Most sowings were of the open pollinated variety, 8931, while the only hybrid sown on a significant scale was Hysun 30. Some crops in favoured areas yielded 50 per cent oil content. Average oil content was expected to be approximately 44 per cent.

The major insect pest was the field cricket (*Acheta commodus*) which damaged over 5 000 ha of newly sown crops in the Moree district. Rutherglen bug (*Nysius vinitor*) caused extensive yield and oil quality losses. White fringed weevil (*Graphognathus Reucoloma*) defoliated some seedling crops in the northwest.

Main sowings in the northwest were exposed to adverse weather from flowering onwards. Substantial lodging, Sclerotinia stem rot (*Sclerotinia sclerotiorum*) and head rots (*Rhizopus* spp.) occurred. Bird damage was also significant, principally resulting from the delayed harvest. Red rust (*Puccinia helianthi*) on open pollinated varieties contributed to yield reductions in crops sown after December. Charcoal rot (*Macrophomina phaseolina*) occurred in crops on the Southern Tablelands.

Soybeans

Production was estimated at 18 000 t from 10 500 ha, an average yield of 1.7 t/ha (11 332 t and 6 695 ha in 1975–6). In the Namoi Valley, average yields and seed quality were reduced by moderate flooding and associated waterlogging in late February/early March, again in May, and hail damage in mid-January and again in April. Harvesting was significantly delayed in most districts by excessive May rainfall and will not be completed until mid-July. Record prices were obtained for soybeans, but the area sown was restricted by a shortage of seed.

Irrigated production, principally in the Namoi, Gwydir and Macquarie Valleys, represented 90 per cent of the crop. The Far North Coast was the major dryland production district. The principal varieties grown were Bragg, Lee and Ruse in central and northern irrigation districts, Bragg and Wills on the coast and Clark 63 and Bathel in southern irrigation districts.

Insect activity was moderate throughout the season. Spraying was frequently required to control green vegetable bug (*Nezara viridula*). The lucerne crown borer (*Zygrita diva*) caused significant damage in the seedling stage in the Gwydir Valley while soybean moth larvae (*Stomopteryx simplexella*) severely damaged young plants in the Riverina.

Diseases caused only minor losses although significant infections of Sclerotinia stem rot (*Sclerotinia sclerotiorum*) were present during autumn and bacterial blight (*Pseudomonas glycinea*) was widespread and more serious than usual in the north-west.

Satisfactory weed control of both grasses and broadleaves was generally obtained with the aid of the available herbicides.

VEGETABLES

Asparagus

The further decline in production in inland areas was offset to some extent by areas near Kempsey and Maitland coming into production for fresh market supplies. In 1975–6 production from 1 831 ha was 3 771 000 kg, an average yield of 2 059 kg/ha. Seasonal conditions were disappointing. Floods in October at Gundagai reduced yield and quality while wet, cold weather during October hampered harvesting at Bathurst and Mudgee.

Most supplies were canned. Green asparagus as opposed to white (blanched) increased because of the shortage of suitable labour for harvesting. Imports of fresh asparagus from New Zealand were again received on the Sydney market.

Beans

In 1975–6, 2 567 264 kg of fresh market beans were produced from 1 031 ha while 3 825 068 kg of processing beans came from 973 ha. Most inland crops were grown under contract to processors whilst coastal production was nearly all directed to the fresh market. Unusually cool, changeable weather during the spring months led to the patchy germination and slow growth of early sown crops.

Hailstorms on the mid-North Coast, waterlogging in the Durriaresq Valley and diseases in the M.I.A. destroyed crops. Processing crops were generally picked with open front harvesters. A large proportion of fresh market growers were using single row mechanical pickers for a destructive harvest after the first flush of beans had been hand-picked.

Clover stunt virus was the most serious disease and caused substantial crop losses in southern areas.

Carrots

During 1975-6, 20 379 t were produced from 948 ha. Seasonal conditions were generally quite favourable in all production district.

The most notable industry trends were the increased adoption of mechanized harvesting, washing and grading; the use of 20 kg plastic bags for topped carrots instead of bunching carrots with the tops intact; and further expansion of prepackaging for the retail trade.

Seedling carrot crops in parts of the M.I.A. were damaged by plague locusts. There was post harvest development of Sclerotinia in some carrots consigned from Singleton.

Cole Crops

Plantings in 1976-7 were similar to those in 1975-6 when 701 ha of cauliflowers produced 388 556 dozen, 625 ha of cabbages yielded 519 316 dozen and 22 ha of Brussels sprouts yielded 412 560 kg. Exceptionally wet weather and local flooding in coastal districts during early March caused extensive damage to seedbeds and field plantings.

Recent significant industry developments were the use of cartons and bulk crates for marketing trimmed cauliflowers, the use of motorized folk lifts for handling unit loads on the farm and at the markets and the use of a boom type mechanical harvesting aid attached to a mobile field packing platform.

The diseases ring spot virus and black rot occurred without being a problem.

During the warm summer and autumn, there were unusually heavy infestations of cabbage white butterfly (*Pieris rapae*), cabbage moth (*Plutella xylostella*) and *Heliothis* caterpillars. Most growers have learnt to control molybdenum deficiency, but boron deficiency is still a common problem. Manganese toxicity occurred in the Tablands.

Cucurbits

Statistics for 1975-6 were:

	Area (ha)	Production	Yield
Pumpkin	1 519	10 894 t	7.2 t/ha
Marrow/Zucchini	156	1 603 t	10.3 t/ha
Cucumber	222	1 762 133 kg	7 955 kg/ha
Rockmelon	329	3 542 t	10.8 t/ha
Watermelon	520	3 937 t	7.6 t/ha

The watermelon area appears to be falling while the zucchini area is rising.

Unusually cool, wet, windy weather in October caused many germination and seedling failures. Hailstorms caused substantial crop losses on the North Coast. Exceptionally wet weather and local flooding caused further crop losses on the coast during late February/early March. The market was generally undersupplied during the spring and early summer due to the heavy loss of early crops. Fusarium root-rot in early rockmelon crops, and powdery mildew in autumn, devastated crops. Leaf-eating ladybirds and pumpkin beetles were the most common insect pests.

Lettuce

Except for very wet weather in February and March, seasonal conditions were reasonably suitable in the major production areas near Sydney and Maitland. Production was similar to 1975-6 when 763 ha produced 978 332 cases. Market prices exceeded the cost of production on only a few occasions during the year.

At Hillston, the lettuce seed crop failed because of plague locust damage; at Dareton, the necrotic yellows virus caused losses of about 40 per cent; at Maitland, necrotic yellows, sclerotinia and downy mildew were troublesome.

Onions

The crop was significantly larger than normal and mostly confined to south-western irrigation areas. In 1975-76, 993 ha produced 20 085 tonnes at an average yield of 20.2 t/ha. Seasonal conditions were satisfactory.

The increased production depressed prices (\$50 to \$60 per tonne) for most of the season. After mid-February prices improved slightly. Exports to Europe and Japan from the Griffith district totalled 5 500 tonnes.

Peas

In 1975-6, 708 ha of fresh market peas produced 1 437 242 kg while 1 820 ha of processing peas produced 4 546 000 kg. Production of processing peas in 1976-7 was 35-40 per cent below target in the south. The fresh market pea areas on both the North Coast and Central Tablelands declined this year.

Drought during winter/early spring followed by torrential rain and flooding in October seriously affected processing crops on the Southern Slopes. Warm to hot, dry weather destroyed many dry farmed fresh market crops on the Central Tablelands.

A serious outbreak of *Heliothis* caterpillars occurred on the mid-North Coast and outbreaks of bacterial blight appeared on the Far North Coast and at Cowra.

Potatoes

Plantings were about 12 per cent greater than last year but production was unaltered. For 1975-6, 8 331 ha produced 117 875 tonnes at an average yield of 14.1 t/ha.

Wet and cold spring weather reduced plant densities, severe late frosts damaged crops on the Northern Tablelands, dry weather from December to February affected all tableland crops, and floods in February destroyed autumn crops at Kempsey and Maitland.

Tuber quality was variable. Market prices were mostly below the cost of production. Increased supplies from South Australia exacerbated the situation.

Potato growers are anxiously awaiting the final report and recommendations of the Industries Assistance Commission following the inquiry into potatoes and processed potato products. They were most unhappy with recommendations of low level of assistance in the draft report.

The potato moth (*Phthorimaea operculella*) damaged tableland crops, the white fringed weevil (*Graphognathus leucoloma*) damaged Mudgee crops while at Maitland leaf-eating ladybirds infested crops.

Target spot (*Alternaria solani*) severely defoliated crops in the Robertson district while also powdery scab (*Spongospora subterranea*) (first observation) and bacterial wilt (*Pseudomonas solanacearum*) infested crops. Black leg (*Erwinia atroseptica*) occurred in most spring plantings while *Rhizoctonia* (*Rhizoctinia solani*) occurred throughout the Finley and Coleambally districts. Manganese toxicity was also diagnosed from a crop near Finley with leaves containing 4 560 p.p.m. Mn while healthy plants had 1 980 p.p.m.

Tomatoes

The area planted to fresh market crops increased slightly over last year while production was slightly less. Processing crop area was static but production increased by about 8 per cent. For 1975-6, the total area of tomatoes was 2 355 ha, the total production 40 211 tonnes and the yield 17.1 tonnes/ha.

Most growers enjoyed a satisfactory season for both fresh market and processing crops. However, hail in November reduced the Tweed Valley spring crop by an estimated 600 tonnes while a severe windstorm in May dropped winter fruit. Heavy rain on the Central Coast in February, March and May made disease control difficult and reduced fruit quality.

The processing crop is being centred at Finley and the Lachlan Valley. About 67 per cent of the crop was mechanically harvested. Some fresh market producers have adopted trickle irrigation and black plastic mulch in their management systems.

Bacterial wilt was the main problem in the Tweed Valley while target spot (*Alternaria solani*) was worst on the Central Coast. Big bud, spotter wilt, bacterial speck (*Pseudomonas tomato*) and fruit-rots (*Colletotrichum* spp) occurred in processing crops and plague locusts destroyed some plantings in the seedling stage.

CITRUS FRUITS

Production and Seasonal Conditions

In 1976-7, the total production of 201 480 t declined by 23 650 t including 17 030 t of Valencias. This led to greater use of Navels for processing.

The production of the principal citrus was: Navels 57 790 t, Valencias 106 260 t, common oranges 430 t, lemons 21 390 t, mandarins and tangors 7 540 t, grapefruit 7 700 t and Seville oranges and others 370 t.

Conditions were generally unfavourable. Coastal districts experienced a cold, wet spring which affected fruit setting, followed by a dry summer causing stress, reduced

fruit size and delayed maturity. Inland districts had a dry winter with frequent frosts and, despite good rain fall in late spring, dry weather during summer resulted in leaf and heavy fruit drop.

Marketing

Processing: A strong demand for Valencias and navels provided competition for the available fruit. On the Central Coast, the fruit processed was about 70 per cent of the Valencia crop, 60 per cent of the lemon crop and 20 per cent of navels. In the lower Murray district, 68 per cent of Valencias, 38 per cent navels and 96 per cent lemons were processed. The M.I.A. processed 50 per cent of Valencias, 45 per cent of navels, 85 per cent grapefruit and 92 per cent of the lemon crop. The price set by the Fruit Industry Sugar Concession Committee remained the same as the previous year (navels \$63/tonne, Valencias \$76/tonne and grapefruit \$78/tonne). The lemon price was increased from \$88 to \$96/tonne at country factories. In some areas, growers were paid prices well above the F.I.S.C.C. minimum because of the scarcity of fruit.

Export: The main export outlets for oranges were New Zealand, Singapore, Indonesia and Malaysia. Small quantities of Ellendale mandarins were forwarded to Canada, Sweden, Germany and Holland. The lower Murray districts supplied most of the fruit for export.

Local Market: Supplies were affected by the expected shortfall of Valencias for processing. Navels met a slow demand in both Melbourne and Sydney but prices increased to \$8 per package late in the season. Valencia sales commenced at about \$3.60 in October and rose to \$6 by mid-April for Murray districts fruit. The percentage of fresh fruit forwarded in bulk bins to market or wholesalers for pre-packing in polynet bags increased. The volume of fruit now being sold direct to wholesalers and retailers from both coastal and inland areas is a reflection on central marketing procedures and packing costs.

Planting Statistics

The total area of citrus since the 1975 census fell by 507 hectares to 12 143 hectares.

New South Wales citrus areas in 1975 and 1976 were:

	1975			1976		
	Bearing ha	Total ha	per cent Non Bearing	(a) Bearing ha	Total ha	per cent Non Bearing
Navel	3 651	3 904	6.5	3 464	3 678	5.8
Valencia	5 563	6 207	10.4	5 409	6 152	12.0
Other sweet oranges	42	43	2.3	36	39	7.7
Lemon	1 021	1 266	19.3	953	1 173	18.6
Lime	3	3	0	4	5	20.0
Mandarin	457	487	6.2	363	392	7.2
Tangor	209	229	8.7	199	206	3.4
Tangelo	14	18	28.6	10	13	22.5
Grapefruit	275	469	41.7	286	463	38.7
Seville and other	22	24	8.3	22	23	8.7
Total Citrus	11 257	12 650	11.0	10 746	12 143	11.5

(a) In 1976, the bearing age definition was reduced from 7 to 6 years from planting for all varieties except lemons and limes, which remained at 4 years.

The continued decline in total area of citrus reflected urban development in the coastal districts which was partly off-set by new plantings of oranges in the inland areas.

Industry Organization

The import of citrus juices at about 30 per cent below the local cost of production brought about good co-operation of the citrus industry for preparing submissions to the Industries Assistance Commission but a section of the M.I.A. and the Hawkesbury Valley maintained an independent stand. The Commission heard evidence in November, 1976, about the long-term need for assistance using increased tariff or quota restrictions on imported juices, and subsequently ruled that quota restrictions set by the Temporary Assistance Authority cease at the end of June, 1977, and be replaced by a 65 per cent *ad valorem* duty on imported juice. The industry is now required to prepare further submissions for a second hearing of the Commission to consider long-term restructuring proposals to meet overseas competition.

Industry Developments

Citrus growers showed considerable interest in the Sydney Farm Produce Market Enquiry Committee which is examining all aspects of marketing at Flemington. Growers saw a rapid increase in the cost-price pressures and are concerned about the role of the central markets while increased costs of packing and distributing citrus have led to reorganization in all districts.

Pests and Diseases

A highlight in citrus pest control has been the disappearance of white wax scale, *Gascardia destructor*, as a result of two parasites released in New South Wales and southern Queensland coastal areas.

Biological control of red scale, *Aonidiella aurantii*, and yellow scale, *Aonidiella citrina* has been promoted in inland districts with some success.

Black spot (*Guignardia citricarpa*) damaged citrus in the Central Coast districts. Grey mould also affected lemons in coastal districts. Greasy spot, the most serious foliage disease in the inland districts, did not cause as much defoliation as in previous seasons as a result of more growers adopting Departmental recommendations. Oleocellosis and rind staining on fruit resulted in losses and rejection for export.

STONE FRUITS

Seasonal Conditions

The dry winter then good spring rain was followed by a hot, dry summer ending with general rain and flooding in late February and March.

Canning Fruits

M.I.A. canning peach production was 14 689 t (13 036 t in 1976) plus 42 t of canned freestone peaches.

The M.I.A. apricot crop yielded 4 044 t (3 671 t in 1975-6) plus 208 t marketed as fresh fruit. This production was remarkable considering tree removals and the advanced age of remaining trees of both peaches and apricots and the sizing problems of peaches. The FISCC prices for canning peaches and apricots were \$150 per t and \$200 per t, respectively.

The area of canning peaches declined to 893 ha (1 074 ha in 1975-6) and of canning and dessert apricots to 411 ha (520 ha).

Although the canning industry has stabilized over the past year and the major New South Wales canner is trading profitably, many growers remain disillusioned with developments in the industry, and removals under the Tree Pull Scheme continued.

Dessert Peaches and Nectarines

Good crops of dessert peaches and nectarines were harvested in all districts, most growers reporting their best season on record for quality and prices. The estimated crops were 11 300 t of peaches from 1 228 ha and 1 090 t of nectarines from 203 ha. Crops set heavily, requiring hand thinning. Dry conditions stressed trees while the autumn rain split some fruit. The season was approximately ten days late. For the first time in many years, new plantings in the outer metropolitan area exceeded removals, with nursery trees remaining in short supply.

Pests and diseases remained at a low level. Green peach aphid (*Myzus persicae*) was difficult to control as resistance to demeton-S-methyl developed. Wingless grasshopper (*Phaulacridium vittatum*) damaged immature peaches at Bathurst while dried fruit beetles (*Carpophilus* spp.) damaged fruit at Bathurst and Mudgee.

Cherries

The total cherry crop was approximately 4 360 t of which Young produced 2 940 t, another record crop, and Orange 1 070 t, well below normal caused by poor conditions at blossoming. White cherry crops were very light.

Cherry crops matured approximately ten days late. A severe hailstorm at Young on 2nd November caused considerable damage to crops in sections of the district. Prolonged dry conditions were ideal for harvesting and crops were generally disease free.

Prices for fresh cherries were the best on record and the canning price increased by 10 per cent.

Cherry plantings declined from 1 813 ha in 1975 to 1 747 ha as losses occurred from waterlogging the previous season and urban development in the Orange district.

Prunes

Young crops were variable while M.I.A. crops were heavy. Production was only 2 750 t (2 899 t in 1976). After grading the crop will be considerably lower than in 1976.

Young district crops were reduced by a heavy shedding and lack of size, and the hot, dry summer and February rains arrived too late to be of major benefit.

M.I.A. crops lacked normal sugar content and growers suffered fruit losses due to excessive softening and premature shedding, fruit cracking and brown rot infection. Further losses occurred in fruit in bulk bins awaiting dehydration.

Processors finalized the 1975 Pool during April with prices ranging from \$775–\$825 per dried tonne. A substantial price rise has been foreshadowed from August, 1977.

Prune crops remained generally free from pests and diseases except for some brown rot infection in the M.I.A. and minor jassid damage at Young.

Plantings of prunes increased slightly to 1 533 ha (1 500 in 1975).

Plums

An excellent crop of Japanese plums occurred in all areas except the Young district where fruit was drought affected.

The Japanese plum crop was estimated at 3 950 t plus 185 t for processing in the M.I.A. but none for processing from Young. The crop of European plums was lighter than normal and estimated at 630 t.

Areas of Japanese plums increased to 520 ha (500 in 1975) while European plums declined slightly to 186 ha (189).

Plum crops were generally free from pests and diseases.

Dessert Apricots

Crops were generally good and were favoured by dry conditions during the early summer period. Fruit matured up to ten days later than normal at Kurrajong while Menindee crops were particularly late. The Caselin crop at Kurrajong was of above average size and excellent quality. Good prices were received for early apricots from the Sydney markets. Due to a decline in the local industry, increased supplies of apricots were consigned from South Australia and Victoria.

Apricot crops were mostly free from pests and disease except for shot hole which blemished some crops.

Apricot plantings including canning apricots declined from 520 ha to 411 ha.

POME FRUITS

Production and Seasonal Conditions

The apple crop was estimated at 106 000 t compared to 72 969 t in 1976. The pear crop was estimated at 7 100 t compared to the previous year's record 23 138 t.

Cool, wet conditions during October contributed to the lightest pear crop for more than ten years.

However, Batlow and Orange growers used thinning sprays to reduce apple crops following a late blossoming and heavy fruit set. The dry summer retarded fruit development where thinning was inadequate and irrigation unavailable. The very light pear crop was not affected.

Hail damage ranged from 20 per cent to 90 per cent on affected New England orchards and at Wedderburn up to 100 per cent fruit damage occurred.

Marketing

The 1976 apple crop sold at good prices from June to December. Quality was generally good and buyer demand was keen for the limited supplies.

Pears maintained good quality during storage and sold at generally satisfactory prices until cleared.

Harvesting of the 1977 apple crop was delayed at Orange and Bilpin. Large early marketed apples met a steady demand and realized good prices.

Demand for processing apples was dull and, in contrast to last year, a surplus over processors' requirements is likely. Pears realized good prices, and prospects are good for cool stored Packham's Triumph.

Exports of apples and pears from New South Wales during 1976-7 amounted to 643 t and 1 170 t respectively compared with 1 223 and 950 t in 1975-6.

Planting Statistics

The New South Wales pome fruit areas at December were:

				1974		1975		1976	
				per cent Ha	per cent Non Bearing	per cent Ha	per cent Non Bearing	per cent Ha	per cent Non Bearing
Apples	..	..	..	5 282	11.2	5 719	9.9	5 343	9.9
Pears	..	..	..	1 050	9.6	1 006	9.2	901	9.7
Total	..	..	..	6 876		6 725		6 244	

Since 1968, the pome fruit area has declined with a further 481 ha fall since 1975.

Industry Developments

The Commonwealth Government terminated the Tree Pull Assistance Scheme on 31st December, 1976. Since the start of the scheme in 1972 growers were financially assisted with the removal of 737 ha of apples trees and 176 ha of pear trees. Additional areas were also removed outside the scheme.

Apple production has not correspondingly fallen, being off-set by yield increases through improved orchard management and removal of low-yielding orchards.

Orange district growers propose to form an apple processing co-operative, mainly to produce apple juice.

Pests and Diseases

Although weather conditions in spring favoured development of apple and pear scab, these diseases were very effectively controlled.

Codling mother (*Cydia pomonella*) was more difficult to control than usual. Two-spotted mite (*Tetranychus urticae*) was troublesome before control measures were taken. Light brown apple moth (*Epiphyas postvittana*) caused significant fruit injury near harvest. European red mite (*Panonychus ulmi*) continued to be a problem in the Batlow district for the third season since its detection in 1974.

BERRIES

Rain during September in coastal areas disrupted the main strawberry harvest and caused heavy fruit losses and diseases. A hailstorm during October seriously damaged crops in the Bargo district. Despite weather losses, heavy supplies in November caused the lowest market prices for several years. Heatwaves in December damaged fruit and rapidly stopped the coastal harvest. High quality packs sold well throughout the season. The autumn crop was well below normal and rain interrupted harvest. Prices for this crop were above normal.

Strawberry plantings increased from 83 to 86 ha during the year as certified runners were in short supply. Adequate supplies of runners were available for 1977 plantings.

Verticillium wilt (*Verticillium dahliae*) was a major problem while leaf blight (*Phomopsis obscurans*) was severe on the coast and alternaria leaf spot (*Alternaria alternata* f. sp. *fragariae*) was serious in Red Gauntlet on the tablelands.

Weather conditions favoured the harvest of trailing berries in the Batlow district where crops yielded 53 t with the canner's price being 80c per kg.

TEMPERATE TREE NUTS

The Moree pecan crop will be harvested with three new machines and yields of 120-140 kg per ha are expected. There were two large pecan plantings, at Bellingen and Muswellbrook.

The area of temperate tree nuts is now 856 ha. Good prospects exist for a wide range of nuts crops in Australia but considerable capital is necessary to establish these industries. Many inquiries are received concerning pecans, walnuts, chestnuts and filberts.

GRAPES

Seasonal Conditions

The dry, frosty winter and the extensive October rain and cool weather retarded growth and delayed harvest. The hot, dry summer caused extreme stress in some Hunter Valley vineyards, particularly those on poor soil types, reducing the potential crop. In the irrigation areas, some mis-timing of irrigations during flowering and fruit set resulted in poor berry set.

Heavy rain during February delayed harvesting, retarded sugar development and damaged the crop, especially in the Hunter Valley. Red varieties, mainly Shiraz, suffered from splitting and bunch rot and were left on the vine. The poor autumn weather continued in the Hunter Valley but elsewhere weather improved to successfully conclude the vintage.

Sultanas suffered some rain damage in February while cool weather delayed drying of raisins.

Wine Grapes

Production: The quantity processed by wineries in New South Wales was estimated to be a record 108 000 (100 000 t in 1976). The M.I.A. wineries crushed 79 494 t including 5 134 t from the mid-Murray areas and 2 072 from the Coleambally district. The average yield per bearing ha was 17.8 t, well below the 22.4 t in 1970. Hunter Valley production was a record at 15 993 t. White varieties were harvested and processed successfully but some 3 300 t of Shiraz were left on vines as unfit to pick. Production per bearing ha was 3.95 t compared with 4.2 t last year and 5.0 t in 1974.

Lower Murray crops produced 10 823 t for crushing while the Corowa and Berrigan crops produced 1 173 t. Mudgee production was estimated at 1 100 tonnes.

Marketing: The prices paid in irrigation areas for red grapes generally fell while white grapes rose. The ruling prices were: Shiraz \$112/t (\$125 in 1976), Cabernet Sauvignon \$200 (\$210), Grenache \$120 (\$107), Semillon \$130 (\$120), Doradillo \$110 (\$96), Muscat Gordo Blanco \$120 (\$110), Palomino \$110 (\$100), Trebbiano \$125 (\$115) and sultanas \$110 (\$100). Despite the lower prices, Shiraz and Cabernet Sauvignon were not easily sold. Distillation for spirit is one way of absorbing the excess but brings lower prices for the grapes. Because of the tight situation, the Wine Grapes Marketing Board vested the 1977 crop. Lengthy negotiations occurred before price agreement with winemakers was reached for Shiraz.

In the Lower Murray, prices increased despite variation between wineries. Sultanas were up \$15, the maximum price being \$104/t while the price of Shiraz fell.

Planting Statistics

The area planted increased by 350 ha of which 175 ha were Cabernet Sauvignon and Shiraz. The M.I.A. area increased by 197 ha to 4 466 ha, the Hunter Valley and Lower Murray were static while Mudgee increased by 62 ha to 486 ha.

Wine Consumption and Export: Wholesale sales by wineries were 169 229 000 litres in 1975-6, an increase of only 7 per cent. During the 5 months August-December, 1976, sales of white wines had increased by 30 per cent over the corresponding period in 1975 while sales of red had fallen by 9.1 per cent. Price discounting of red wines became common. Brandy sales also dropped over the same period by 41 per cent largely because of excise increases.

Export of wine and brandy again dropped during the 12 month period by 6 per cent and 19.4 per cent, respectively. Imports of wine increased by 36 per cent. Both imports and exports of wine were nearly equal in volume, each representing less than 2 per cent of the 1976 production or about 4 per cent of sales.

Industry Situation: The M.I.A. Wine Grapes Planting Advisory Committee stressed that production of red wine was at its upper limits. For white wines, however, it reiterated the winemakers' need for greater tonnages of Muscat Gordo Blanco, Trebbiano and Frontignan. Premium varieties such as Traminer and Chardonnay had almost reached an adequate level but limited increases could still be utilized.

In the Hunter Valley, some grapegrowing/winemaking companies faced severe liquidity problems and one went into receivership. The problems were partly due to excess red grapes, lack of market outlets, excess capital debt and bad seasonal conditions.

Mechanical harvesters were increasingly used in irrigation areas but restricted by wet weather in the Hunter Valley. Mechanical pruning has widespread adoption.

Dried Vine Fruits

Production and Marketing: Preliminary figures for the New South Wales production in 1977 are 432 t of currants (236 in 1976), sultanas 8 400 t (6 752), and 885 t of raisins (1 239). The size and quality of the currant crop improved. Despite some rain at harvest, good drying ensured fairly good sultanas. However, with the raisins, drying was difficult with cool weather and late maturity.

Planting Statistics: The total planted area of drying grapes in New South Wales remained relatively static.

Industry Situation: Rain damage to the dried vine fruits crop in California created a worldwide shortage and considerable price increases. Unfortunately, the 1976 Australian crop was sold before this shortage became apparent but grower returns for the 1977 crop promise to be higher at about \$725 per sweat box tonne. As high returns for dried vine fruits are likely for at least another season, trellising improvements, renewal of equipment and replanting of vacant land have been stimulated.

Following the publishing of the I.A.C. report on the Dried Fruits Industry, considerable industry criticism occurred and the Commission decided to re-examine various aspects raised.

The poor labour situation led to increased use of trellis drying, harvesting devices and pneumatic pruning rigs.

Table Grapes

From the M.I.A. fresh fruit outlets amounted to 1 235 t (1 743 t in 1976). Table grapes included in the crushings for wine amounted to 1 110 t (1 382). In the Lower Murray area the estimated table grape production was 1 200 t, of which 60–70 per cent were sultanas.

From Euston area about 2 400 t were forwarded to fresh fruit markets and substantial quantities were forwarded from the mid-Murray. About 200 t of table grapes were produced in Mudgee. A further decline of 18 ha occurred in the near metropolitan areas.

TROPICAL FRUIT

Seasonal Conditions

The dry summer checked growth of most sub-tropical fruits. Many of the "November" banana bunches in the Coffs Harbour–Macksville area were unmarketable and heavy shedding of fruit occurred in avocados, macadamia and passionfruit. During November, scattered hailstorms caused severe damage to isolated banana plantations in most districts.

Since February, good rainfall and hot humid conditions led to excellent plant growth. However, heavy rain and strong winds during 16th–18th May destroyed between 40 per cent and 50 per cent of bunched plants in the Coffs Harbour–Macksville area, 25 per cent on the Richmond, 10 per cent on the Brunswick and 15 per cent on the Tweed. Some plantations lost up to 85 per cent of their crop.

Bananas

Production and Marketing: Production rose from 71 269 t last year to 92 169 t. This comprised 2 940 751 wooden 24 kg cases and 1 199 318 fibreboard 13 kg cartons. Cartons consigned were 41 per cent of the total packages but the pattern is for more cartons in summer and cases in winter.

Production rose to very high levels in late November and December and the National Banana Market Development Scheme re-introduced railhead clearance with up to 30 per cent of consignments being removed to keep prices at economic levels. In February, grade "Five" fruit was removed from the market due to the very poor demand.

Queensland growing areas suffered from cyclonic winds and rain in late February and the greatly reduced supplies allowed prices to rise to \$14–\$17 per case. New South Wales growers, with much winter fruit hanging, faced one of the best years on record. However, the wind damage in May affected many.

Planting Statistics: The area of bananas in New South Wales declined to 6 475 ha, the lowest since 1944. This gradual decline has continued since the peak of 12 138 ha in 1960.

Industry Organization and Developments: The Banana Growers' Federation during the year organized the palleting of all bananas from New South Wales transported to Sydney and Melbourne.

The National Banana Marketing Development Scheme changed to operating separate funds for Queensland and New South Wales, to prevent criticism by growers that their funds were subsidizing growers in the other State.

Insect Pests and Diseases: Bunchy top incidence in bananas decreased from 2 006 infected plants last year to 1 849 and occurred only in the Tweed and Brunswick areas. The increase from 343 to 765 in the Brunswick areas was of concern. With the increasing incidence on the Brunswick, detection staff cannot maintain normal inspection programmes at satisfactory levels.

Following the development of dieldrin resistance in banana weevil borer (*Cosmopolites sordidus*) in the northern areas, good results were gained by the use of alternative chemicals. Banana spider mite (*Tetranychus Pamb*) damaged young plantings in the Tweed district and foliage in the Richmond district.

Avocados

The area increased by 49 ha to 409 ha and nurserymen were unable to supply sufficient trees to meet the demand. Small plantings totalling 17 ha of avocados along the Murray River continue to flourish and expansion to 250 ha in 5 years is predicted.

Avocado growers in Queensland and New South Wales want maturity standards introduced with 12 per cent oil or the equivalent dry matter content as the minimum acceptable level.

Some 29 430 one-third bushel cartons of fruit (213 t) were marketed. There were 4 small consignments totalling 1 700 trays imported from California, two of which were deep buried due to breakdown or incorrect quarantine certification. The imports sparked strong grower reaction due to the alleged threat of introducing a disease known as Black Streak. Frozen halves (without seed) and canned pulp have since been introduced from California.

Swarms of monolepta beetles (*Monolepta australis*) caused damage to many orchards in one of the worst years for this pest. The dry spring and summer reduced losses from root rot (*Phytophthora cinnamoni*).

Macadamia Nuts

Plantings markedly increased from 429 ha to 658 ha. Although only 186 ha is bearing, production of 21 tonnes of nuts in shell is expected. The strong winds in May showed weakness in the root system of seed grafted trees. Phytophthora canker is becoming recognized as an increasing problem.

Miscellaneous Tropical Fruits

Interest continues to increase in crops such as guavas, litchis, custard apple and papaw. Excellent potential exists for their development, especially on the red basaltic soils in the Richmond River district where one grower planted 14 ha of litchis.

WOOL AND SHEEP MEAT

Seasonal Conditions

Severe drought in southern New South Wales caused widespread drought feeding with many stock being agisted. Late rains prevented adequate grazing until spring. However, northern areas had a reasonable winter followed by an excellent spring.

The hot dry summer ended with the February flood rains in central and northern centres. Further widespread flooding occurred in May. Early winter feed in the far southwest was inadequate.

Stock Numbers

Sheep numbers showed a 5 per cent decline to 50.5 million while cattle numbers declined by 5.7 per cent to 8.6 million. The decline in sheep numbers was largely attributed to the severe drought, the grazing pressure of record cattle numbers and the large area under wheat. Widespread flooding in many areas affected lamb marking percentages.

The seemingly insatiable demand for live sheep for export will prevent any rapid increase in sheep numbers, especially Merino wethers.

Wool Production

Despite the severe drought of last winter, the average wool cut at 4.2 kg per head was 2.4 per cent higher than for the previous year.

Production was 213.4 million kg, only 1.7 per cent lower than in 1975-6 even though the number of sheep shorn declined by 3.8 per cent.

Mating and Lambing

Preliminary estimates show that lamb marking figures for 1976-7 will be about 69 per cent. The southern drought and flooding in the north contributed to the low percentage.

The number of ewes joined showed virtually no change but are expected to increase next year.

Profitability

Gross returns to sheep breeders remained relatively static during the year. Fluctuations in wool prices were countered by devaluation while sheep prices tended to show a steady improvement. However, price rises were less than the rising costs. Overall net income in real terms fell slightly during the year.

Wool Prices

The minimum floor price for 1976-7 was fixed at 275 cents per kg (250 c. per kg in 1975-6) on a clean basis for 21 micron wool.

The average auction price for greasy wool for the 1976-7 season was 184 cents per kg which was 30 per cent above the average price for the previous season. The reserve price indicator, previously 21 micron wool, was replaced by a clip average reserve price indicator. This is a weighted average of the prices of a number of different wool types representative of the composition of the total wool clip. On this basis, the minimum reserve price was set at 234 cents per kg clean.

Following the 17.5 per cent devaluation of the dollar in November, 1976, the Australian Wool Corporation minimum reserve price was raised to 284 cents per kg. Following further minor adjustments to exchange rates and improved demand during November, the market indicator rose from 280 cents pre-devaluation to 334 cents in February, but by the close of the season this price had declined to around 300 cents per kg.

Cost savings of \$90 m annually may occur in a few years by using jumbo bales, sale by sample, streamlined delivery and more efficient sheep handling. Approximately half of these savings are expected to flow on to producers to offset rising costs.

Sheepmeat Production

In 1976-7, lamb production declined slightly to 63 800 t (69 800 t in 1975-6) from 3.8 m lambs (4.1 m in 1975-6).

The decline was partly due to poor finishing of lambs in the spring. The decline is expected to continue. Mutton slaughterings increased to 3.0 m (2.6 m in 1975-6) mainly because of the drought. However, demand for export mutton continued with Japan taking 54 per cent while the Middle East took nearly 60 per cent of exported lamb.

Australian Wool Corporation Wool Marketing Plans

The 1973 Australian Wool Corporation Wool Marketing Plan proposed acquisition of the wool clip continued to be debated. Many aspects of the plan, e.g. minimum reserve, flexible reserves, overseas stocks and market supply, have been successfully implemented. However, the major step of acquisition is still unresolved.

Alternative proposals include:

- Acquisition of all six bale lots, which would be a 45 per cent acquisition scheme.
- A voluntary acquisition scheme.
- A central wool exchange through which all wool passes.
- A marketing trial "The Limited Opportunity to Purchase Scheme", has been proposed for the 1977-78 selling season.

Carpet Wool Production

Successful carpet wool types were bred using Romney Marsh ewes joined to Tukidale rams imported from New Zealand. Ram progeny from this cross have been sold to other interested breeders.

Carcass Classification

Technical requirements of the carcass classification under the Australian Meat Board's research and development programme were met.

The standing committee has endorsed the concept and recommended the allocation of funds for equipping twelve abattoirs throughout Australia during 1977 to undertake a cost/benefit analysis over 12 months under operational conditions. Two such chains will be set up in New South Wales, the sheep chain being at Riverstone.

The Department has co-operated with the Australian Meat Board in preparing a brochure which will be included with the computer print out forwarded to each producer following slaughter and classification of his stock.

Sheep Handling Devices and Wool Harvesting

Since the early 1970's many sheep handling devices have been developed and alternative shearing procedures have been evaluated. An Australian Wool Corporation Workshop held in Wagga in June, 1977, critically appraised and analysed all aspects of sheephandling and wool harvesting.

Objective Clip Preparation

Of the 906 498 bales sold in New South Wales during 1976-7, approximately 52 per cent was classed in the traditional manner with 48 per cent being prepared objectively. As not all wool is suitable for objective clip preparation, most suitable wool was prepared objectively. Industry has rapidly adopted the technique.

Objective Measurement in Sheep Breeding

A fleece measurement service started in February, 1977, from Trangie Agricultural Research Station by providing greasy fleece weight and fibre diameter classifications on entire ram drops as a free service to producers.

The service can also be used to screen for reserve rams which are then certified, and tested for yield and fibre diameter at commercial testing houses. So far 2 500 samples have been tested.

Hopefully the new fleece measurement service will have a big impact on the availability of fleece measurement data from studs.

The Sheep Blowfly

The sheep blowfly still causes major economic and management problems. With resistance to insecticides and the high cost of treatment, breeding resistant sheep, mulesing and strategic crutching and shearing received increasing emphasis.

Mulesing very effectively controls crutch strike and has been widely adopted by industry. The recent development of a phenol preparation for chemical ringing and mulesing is being investigated.

Grass Seed Contamination of Sheep Carcasses

The problem of grass seed infestation is assuming new proportions in relation to live sheep export trade to the Middle East.

AGRICULTURAL MACHINERY

Sales of large tractors, ranging up to 224 kW, and cultivation equipment to match have been buoyant throughout the year. Relatively small manufacturers and private individuals have commenced building mammoth size cultivators to suit individual requirements or to meet market demands.

Self-propelled harvester prices increased drastically during the year with some imported models exceeding \$100,000. Despite this, sales of new headers were buoyant in the northwest. Good second-hand headers are almost unprocurable.

Small country-based engineering works are having difficulties in finding sufficient work to keep staff employed full time.

FACTORS OF IMPORTANCE TO A NUMBER OF INDUSTRIES

Mineral Problems

Potassium deficiency occurred in bananas and avocados on the North Coast. Bananas also showed zinc deficiency. Boron deficiency was found in bananas and crucifers on the tablelands. Low calcium levels appeared in tableland apples. Manganese toxicity occurred in lucerne and cabbages on the tablelands and in potatoes at Finley. Chloride toxicity was reported in citrus at Narromine while nickel toxicity occurred in oats at Cootamundra.

Insect Pests

Controlling insect pests of stored grain continues to be a major problem due to widespread resistance to malathion and dichlorvos.

During the first six months storage of new season wheat at G.E.B. silos, considerably fewer infestations with lesser grain borer (*Rhyzopertha dominica*) were detected than in the previous season, and the most prevalent stored grain insect found

was rust-red flour beetle (*Tribolium castaneum*). This reversal of the normal occurrence reflects the introduction of treatment mixtures of malathion or dichlorvos with bio-resmethrin or synergized pyrethrins capable of controlling strains resistant to dichlorvos and malathion.

The Australian meal moth (*Plodia interpunctella*) severely infested 2 000 tonnes of sorghum seed at Finley. Warehouse beetle (*Trogoderma variabile*) infestations at rice mills in the M.I.A. delayed grain intake while control measures were carried out.

Australian plague locust (*Chortoicetes terminifera*) caused extensive damage to pastures in the central west and southwest. Infestations between September and December attacked rice, vegetable crops, lucerne and sorghum and caused minor damage to barley and wheat.

In the north, locusts damaged pastures, maturing summer crops and young winter cereals during the autumn.

BEEF

Preliminary figures for New South Wales indicate:

- (1) The first major downturn in cattle numbers (5.7 per cent) since 1965-6.
- (2) Record levels of slaughtering for both cattle and calves, calf slaughter from beef herds at high level.
- (3) Record Australian levels of beef and veal export on monthly basis reached in April, 64 543 t.

Comparative Statistics

Cattle numbers				N.S.W.	Australia
1976	..	..	..	9 138 000	33 434 000
1977	..	..	..	8 620 000	32 008 000
Change per cent	..	..	..	-5.7	-4.3
Cattle slaughtered (10 months ending April)					
1976	..	..	..	2 126 700	6 868 000
1977	..	..	..	2 323 200	7 468 800
Change per cent	..	..	..	+9.2	+8.0
Calves slaughtered (10 months ending April)					
1976	..	..	..	336 800	1 707 000
1977	..	..	..	396 900	2 035 800
Change per cent	..	..	..	+17.8	+19.0
Beef and Veal produced (tonnes carcass wt) (10 months ending April)					
1976	..	..	..	441 000	1 488 000
1977	..	..	..	457 000	1 565 000
Change per cent	..	..	..	+3.6	+5.1
Beef and Veal exports (tonnes shipped wt) (10 months ending April)					
1976	..	..	..	N.A.	446 578
1977	..	..	..	N.A.	503 988
Change per cent	..	..	..		+12.8

Beef Prices

With continued over supply, average beef prices were between 40 and 50 cents per kg estimated dressed weight for most of the year. However, yearling beef reached 60 cents per kg for a short period and export cow beef improved from 28 cents per kg (July, 1976) to 40 cents per kg (March, 1977).

Seasonal Conditions

Severe drought in the southwest led to unprecedented demand for information on drought feeding. A total of 465 people attended 11 functions organized by the district livestock officer at Albury during August, 1976.

Depletion of fodder reserves and delayed sowing of crops held many shires in drought until the good general rains in February.

More favourable conditions in the north and the west provided opportunity for agistment of cattle from the south but the State generally remained overstocked.

PIGS

Pig Production

Preliminary figures indicate that pig numbers rose by 6.48 per cent from 708 785 in 1976 to 754 745 in 1977. In the 11 months to May, pigmeat production was approximately 10 per cent greater than during the same period last year.

The increased pigmeat production resulted mainly for expansion of the larger established piggeries. Higher feed costs forced producers to improve their sow herd efficiency (i.e. pigmeat produced per sow).

The national gross return from the industry was \$189 million (\$60 million from New South Wales) a rise of \$5 million on the previous year.

During 1976-7 3 700 tonnes of pigmeats were exported valued at \$5.8 million. This represented 2.02 per cent of Australian pigmeat production.

Cost—Price Structure

Profit margins were reduced by lower pigmeat prices and higher feed costs. The protein supplement, meat meal peaked at \$270 per tonne. The prices of other protein supplements and grains were also high. The high costs of building, labour and feed deterred most prospective newcomers from entering the industry.

Consumption of Pigmeat

Per capita pig meat consumption fell to an estimated 11.6 kg per head in 1976-7, the lowest level since 1967-8.

A National Pig Meat Promotion Committee was formed and a pig meat promotion campaign initiated.

POULTRY

Egg Production

New South Wales produced 72.9 million dozen eggs in the 11 months to May, 1977. Local sales declined by 1.5 per cent and were 77.4 per cent of production. The balance was exported to unprofitable overseas markets.

Returns to producers from the Egg Marketing Board rose to 76.5 cents per dozen while producer organizations committee estimated cost of production at 85.2 cents per dozen. Increased feed and labour costs largely offset the increased returns.

The C.E.M.A.A. hen levy remained at \$1 per hen but strong pressure exists to increase the levy to \$2 to remove the need for local pools and make interstate trading of eggs less attractive.

Impurities in batches of Marek's Disease vaccine caused severe growth rate depressions in some pullet flocks.

The Egg Industry Stabilisation Act was amended to allow hen quotas to be varied at short notice to provide more accurate production control. A 10 per cent reduction in the hen quota is imminent.

Following appeals by a small group of poultry farmers, known as the Poultry Farmer's Defence Committee, an independent inquiry commissioned by the Minister recommended minor changes in individual hen quotas.

Although few quotas transferred, the price rose to \$7.50 to \$8 per hen.

Poultry meat Production

Production of meat chickens for the nine months to March, 1977, was 48 545 000 birds, a 2 per cent increase. The wholesale price of meat chickens fluctuated during the year with the closing price being about \$1.50 per kg. Increased demand for fresh chickens at the expense of frozen chickens led to the recent price fall.

All integrated companies paid an average growing fee of 16.8 cents per bird marketed following growers negotiations. To stabilize the industry, legislation to control contracts between processors and growers is being drafted. Returns to broiler growers who were paid on a liveweight basis, increased from 55 to 70 cents per kg during the year.

The demand for turkeys, ducks and pheasants remained high.

HONEY

For many producers the season was the worst they had experienced, with the lack of blossom on major honey producing trees and unfavourable rainfall in most ground flora regions.

Record prices for honey did not offset the low production. Packers clamoured for supplies to meet their domestic and export commitments. Prices reached 72 cents per kg for honey and \$3.50 per kg for beeswax.

DAIRYING

All districts, except Maitland and Muswellbrook, experienced a dry winter, especially in southern districts, with severe feed shortages.

Early spring was cold, dry and windy in all districts except Nowra, Wagga and Bega, where heavy rain caused flooding.

The dry summer in northern districts retarded pasture growth while haymaking conditions occurred at Nowra and Windsor, Wagga and Deniliquin districts had severe locust plagues.

Widespread rain throughout the State in autumn and early winter led to water-logging and some flooding which reduced milk production and solids—not—fats.

The spotted alfalfa aphid and blue-green lucerne aphid seriously damaged lucerne and red clover pastures. This resulted in a sharp drop in production and a rapid rise in the price of hay.

Production

The number of registered dairymen declined by 4.9 per cent to 4 400 during the year and total milk production fell by 12.43 per cent to 941 766 720 litres in 1976–7.

Milk Utilization

Many farmers limited milk production because of the poor economic conditions.

Manufactured dairy products used 415 444 071 litres, or 44.1 per cent of milk produced. This fall of 30 per cent caused considerable concern in the industry.

Butter

Production declined by 37 per cent to 6 801 372 kg while consumption dropped by 21 per cent to 12 154 000 kg. Interstate imports increased slightly from 15 086 175 kg in 1975–6 to 15 787 000 kg in 1976–7. Butter oil production was only marginally down on last year to 2 865 809 kg.

Unless suppliers are encouraged to produce manufactured milk, New South Wales will have only a milk industry and manufacturing will cease.

Cheese

Total production of all natural cheese showed a very slight decrease to 13 612 477 kg. Cheddar production declined by 20 per cent to 7 254 523 kg in 1976–7, Mozzarella production decreased 10 per cent to 851 397 kg, Cottage Cheese types fell by 30 per cent to 1 605 047 kg and Ricotta production declined by over 50 per cent to 418 378 kg. However, Camembert increased by 25 per cent to 54 384 kg, Fetta almost trebled to 887 237 kg, and the hard Italian varieties (Romana, Sardo, etc.) showed a similar increase to 451 235 kg. These trends are expected to continue.

Milk Powder

Production of skim milk powder increased slightly to 9 812 but remained 59 per cent lower than the 1974–5 peak.

Most other classes of powder showed decreases ranging from 4 per cent for full cream powder to 65 per cent for buttermilk/skim milk mixture, and 92 per cent for stock food. Infant foods were a notable exception, with an increase of almost 75 per cent to 3 140 046 kg.

Condensed and Evaporated Milks

Sweetened condensed milk production fell 21 per cent but evaporated skim milk production showed an outstanding increase from just over 2 million to 24 million kg. Much of the skim milk was marketed as concentrated instead of powder.

Cultured Products

Marked increases of yoghurt (37 per cent) to 10 million litres and of sour cream (36 per cent) to 1.6 million litre occurred.

Cream Mix and Thickened Cream

Cream mix and thickened cream production increased by 19 per cent to 2 230 583 litres.

Industry Developments

Increased costs of production at both farm and factory level and lower prices for some products made 1976–7 a difficult year for the dairy industry.

Redistribution of market milk quotas began. Part of the quota of farmers with large entitlements was acquired and distributed to farmers with low quotas. In all, a total of approximately 12 million litres was reallocated.

Alternatives to Dairying. The lower export prices for most manufactured dairy produce brought renewed interest in farms located in areas where cash crops can supplement their income.

Basis of Payment for Milk. The committee appointed by Standing Committee on Agriculture to investigate the basis of payment for milk for both markets and manufacture purposes, finished its report in November, 1976, and was accepted in principle by Agricultural Council in February, 1977.

The recommendations were:

- The Committee endorsed the recommendations of its 1972 report that the price paid for milk for manufacturing purposes should be based on the mass of fat and the mass of protein contained in the milk.
- The Committee did not recommend the inclusion in the payment formula of a volume factor based on processing costs but recommended that the farmer be charged on a volume basis for the transport cost of milk from the farm to the factory.
- On market milk, the Committee recommended:
 - (i) that the 1972 recommendation, that milk for manufacture be paid on the basis of the mass of fat and the mass of protein, apply to market milk with a financial adjustment to make up its residual market value

The Committee recognized two ways of making the financial adjustment:

- (a) increasing the price of fat and/or protein
- (b) inclusion of a third factor, based on volume.
 - (ii) that standardization of market milk for both fat and protein be legally permitted.
 - (iii) that no minimum compositional standards should apply to the producers of market milk.
- The committee recommended that existing legislation be expanded to enable processors to enter into agreement with their suppliers concerning the basis of payment for milk on a fat basis or a protein basis, or a combination of both. Legislation should also require that processors maintain an accountability to the producers for that component, or components, on which the payment is based.

A report will be released for industry comment.

Production of Cheese and Cultured Milk Products in Country Districts

Non-cheddar cheese manufacturers showed an active interest in transferring their establishments to country districts or expanding those already operating in the country.

Effect of Quarantine Regulations on Cheese Imports

Quarantine regulations governing the import of cheese were proclaimed on 22nd September, and gazetted on 28th September, 1976, as part of the Commonwealth Government's precautions against the introduction of foot and mouth disease.

Eleven countries, viz., United Kingdom, United States, Canada, Northern Ireland, the Republic of Ireland, Denmark, Sweden, Norway, Finland, New Zealand and Japan, were exempted from the regulations because of their satisfactory foot and mouth disease status.

All other countries were required to withhold cheese from the Australian market for 120 days from the date of shipment to Australia, and to store it at not more than 2° C. In addition, the manufacturer or his delegate is required to provide a declaration before the end of the withholding period, that the cheese attained a pH of 6.0, or less.

The new regulations did not cause the serious decline in imports forecast by retailers, agents and others. In fact, an increase of 4 per cent occurred to 4 056 530 kg. However, imports from exempt countries rose from 1 816 107 kg in 1975-6 to 2 352 732 kg in 1976-7 while restricted countries imports fell from 2 073 323 kg to 1 703 798 kg.

2. ADMINISTRATION

CENTRAL ADMINISTRATION

Central Administration embodies the Executive and branches providing centralized administrative services for the Department. The main functions of the branches are:

Central Secretariat

Provides secretarial and service assistance for the Minister and Executive, keeps central records, handles general correspondence and that relating to the Royal Botanic Gardens, Government Domain and Centennial Park.

Staff and Personnel

Concerned with recruitment, induction and counselling of staff, processing of matters related to salary, allowances, promotion, leave and seniority and the maintenance of salary, leave and other staff records.

Accounts

Receives and pays public moneys, keeps financial records, controls purchases, and inspects accounts of branches and institutions.

Legal

Promotion and drafting of bills, drafting of regulations and proclamations, conduct of prosecutions, preparation of legal documents and legal advisings, registration of veterinary surgeons and licensing of farm produce agents.

Management Services

Responsible for office and ancillary accommodation, layout of offices, office facilities, including furnishings, telephones and telex, forms design, organization and methods surveys.

Pesticide and Environmental Matters

There are two separate units,

- (a) the Registrar of Pesticides who performs a technical administrative service in relation to the registration of pesticides under the Pest Destroyers Act, 1945, and associated matters, and
- (b) the Director of Pesticides and Environmental Studies, who is responsible for the review, development and co-ordination with other Divisions, Branches, Departments and Authorities of research and extension relating to pesticide residues and other environmental problems of concern to the Department.

ACCOUNTS

Staff Development Section

Plans, organizes and conducts staff training programmes in implementation of the Human Resources Development Scheme laid down by the Public Service Board and deals with all matters involving in-service training of staff.

Separate reports are given in this section of the more important activities during the year of the Central Administration components.

Departmental

The Department of Agriculture's day-to-day running costs are met from Consolidated Revenue Fund. Receipts from the administration of various Acts of Parliament, as well as contributions from the Commonwealth towards certain specified functions, are paid into Consolidated Revenue.

Expenditure during 1976-77 by the Department totalled \$45,469,070 from Consolidated Revenue Fund while revenue amounted to \$10,000,269.

The expenditure of \$45,469,070 financed, among other things, such functions

as:

	\$
Cattle Tick Control	6,288,896
Royal Botanic Gardens upkeep .. .	1,742,774
Maintenance of Department's Research Stations ..	6,539,456
Maintenance of Agricultural Colleges .. .	1,919,718

Extension and Applied Research

Apart from finance from Consolidated Revenue, the Commonwealth provides a special grant known as Australian Extension Service Grant. Expenditure from this source amounted to \$2,292,945 during 1976-7 and was devoted entirely to Extension and Applied Research.

Other Research Finance

Funds provided by industries, semi-government bodies and special Commonwealth grants are utilized in many research programmes and projects conducted by the Department of Agriculture. The Department relies heavily on this finance for research work and these sources provided \$2,111,957 in 1976-7. Details of major fund sources are shown in the following statement.

<i>Fund</i>	1974-75 \$	1975-76 \$	1976-77 \$	Total \$
Industry/A.E.S.G. — Special Research Fund	17,800	43,910	69,070	130,780
Wheat Industry Research Committee of N.S.W.	103,160	127,314	227,620	458,094
Wheat Industry Research Council ..	88,314	121,746	212,382	422,442
Australian Meat Research Committee	323,638	349,512	479,949	1,153,099
Wool Research Trust Fund ..	381,124	371,108	383,336	1,135,568
Australian Wool Corporation Post-Graduate Scholarships ..	13,350	7,175	4,800	25,325
Dairy Research Committee ..	54,740	47,705	28,440	130,885
Tobacco Industry Trust Account ..	73,061	52,630	56,858	182,549
Rural Credits Development Fund ..	71,380	104,218	95,000	270,600
Council of Egg Marketing Authorities of Australia	18,386	36,980	19,630	74,996
Australian Chicken Meat Research Committee	29,518	18,530	23,340	71,388
Dried Fruits Research Committee ..	30,310	27,885	26,750	84,945
Australian Pig Industry Research Committee	84,443	56,134	70,740	211,317
Australian Biological Resources Study Interim Council ..	18,550	35,394	12,512	66,456
McGarvie Smith Institute	17,700	19,620	Not available	
	\$1,325,774	1,419,861	1,710,427	4,418,444

Capital Works Programme

Funds for various capital works programmes are provided from General Loan Account and Commonwealth Grants under the Advanced Education and Technical Training Acts. General Loan is financed entirely by the State of New South Wales, while Advanced Education was financed \$1 for \$1 by the Commonwealth and the State up to 31st December, 1973. Thereafter it was financed entirely by the Commonwealth. Technical Training is wholly financed by the Commonwealth.

Expenditure in 1976-7 on capital works amounted to \$1,396,306 made up of \$1,129,000 from General Loan, \$218,419 from Advanced Education and \$48,887 from Technical Training Funds.

Details of the Department of Agriculture's financial operations under Consolidated Revenue Fund, General Loan and various Special Deposits Accounts appear as an appendix to this Report.

OFFICE ACCOMMODATION

During the past year, continued progress was made in the programme to upgrade office accommodation throughout the State. District offices were relocated into new premises at Coffs Harbour, Forbes, Barham, Warren, Yass and Glen Innes. In each case the standard of accommodation was substantially lifted.

The district office at Campbelltown was closed down and the officers transferred to Windsor District Office.

Planning commenced and is still proceeding for the occupation of proposed Government office buildings in Broken Hill, Narrandera, Kempsey, Gunnedah, Mudgee and Muswellbrook. Planning is also proceedings for the relocation of the Regional office, Lismore, to a new building being constructed by the Housing Commission of New South Wales.

Arrangements are proceedings for the relocation of district offices at Maitland, Coonamble, Macksville, Tumut and the district veterinary office, Newcastle, to alternative suitable premises in those centres.

The impact of open office planning and barring of STD are still adversely affecting morale, efficiency and productivity of staff at country offices. This has been particularly in evidence at Moree, Bathurst, Orange, Dubbo and Grafton. It is not possible for the extension officers to visit many more farmers, and fewer farmers are visiting the office. The difficulty of contacting these farmers other than by 'phone has seriously affected counselling and provision of information generally.

The installation of telex units has been approved for the district offices at Condobolin, Glen Innes and Narrandera and at the Veterinary Research Station, Glenfield, and Yanco Agricultural College.

A mini-computer and document reproduction facilities have been approved for installation at Yanco Agricultural College.

Data processing terminals have been installed at the research centres at Trangie, Wagga and Wollongbar, and approval has been given for the installation of a terminal at Tamworth Research Centre.

Microfilm equipment comprising a camera and viewing equipment has been installed at the Wollongbar Research Centre.

COMMITTEES, COUNCILS AND TRUSTS

Australian Agricultural Council

The Council, which comprises principally the Ministers for Primary Industry and Agriculture of the Commonwealth and the States, met on four occasions during the year, at Bundaberg, Sydney, Launceston and Melbourne. Two special meetings were held in Sydney and Melbourne to discuss dairy industry marketing arrangements; the beef industry stabilization scheme; new pest occurrences including the warehouse beetle and the spotted alfalfa aphid.

Meetings of the Standing Committee, which are attended by delegations from the respective Departments led by the Permanent Head, were held on six occasions; at Bundaberg, Sydney (twice), Launceston, Canberra and Melbourne. Special meetings were held at Sydney (twice), Canberra and Melbourne, and at these meetings the principal topics discussed were the dairy industry marketing arrangements; margarine quotas; A.C.T. hen quotas and the Australian Extension Services Grant funding arrangements. Some of the more important matters dealt with at the ordinary meetings held at Bundaberg and Launceston were proposed reconstitution of the Australian Meat Board; National Carcase Classification; Grain Infestation and the National Beef Recording Scheme.

Farrer Memorial Trust

An annual and one ordinary meeting of the Trust were held during the period reviewed.

Total funds held by the Trust at 31st December, 1976, amounted to \$45,312.48 which comprised \$44,420.00 invested in gilt edged securities; assets totalling \$517.50 and cash at bank amounting to \$374.98. Donations received during the year totalled \$1,256.00. The Auditor General of New South Wales certified that an examination of the Trust accounts at 31st December, 1976, was satisfactory.

The 1976 Farrer Memorial Oration was delivered by Dr R. A. McIntosh, Senior Research Fellow, Department of Agricultural Botany of the University of Sydney. Dr McIntosh chose the title "The Genetics of Wheat and Wheat Rusts since Farrer" for his address. The function was organized in conjunction with the New South Wales Branch of the Australian Institute of Agricultural Science and took place in the Great Hall of the University of Sydney on the 9th September, 1976.

It was during this year that the 1972 Farrer Memorial Research Scholar, Mr R. A. Hare, completed his studies under the Scholarship, leading towards the award of a Ph.D. from the University of Sydney. Mr Hare's thesis was entitled "Non-specific Resistance to Stem Rust of Wheat".

Mr S. N. Spear, who holds the 1976 Farrer Memorial Scholarship, continued his studies under the Scholarship at the University of Queensland. Trustees have approved of his entering into a second year of study under the Scholarship.

Royal Botanic Gardens and Government Domain Trust

Three meetings of the Trust were held during the year and some of the more important matters discussed included the destruction by fire of the Royal Botanic by The Sydney Committee and leasing arrangements for the Government Domain arrangements associated with the use of the area for the Festival of Sydney as organized Gardens Kiosk; the proposed installation of a "bush track" in the Government Domain; Kiosk.

A highlight of the year's activities was the unveiling by Her Majesty the Queen of a plaque, in the Royal Botanic Gardens, on Sunday 13th March, 1977, naming The Queen Elizabeth Walk in commemoration of the Silver Jubilee year. On this occasion Trustees were met by the Queen and His Royal Highness The Duke of Edinburgh.

STAFF STATISTICS

Appointments and Retirements—Central Administration

Dr F. C. Butler, Senior Deputy Director-General, resigned from the Department in order to take up the statutory appointment of Chairman, Dairy Industry Authority. Dr Butler had a notable career with the Department, spanning some 35 years during which time he was successively a research officer, Principal of the Wagga Agricultural College and a top level professional administrator with major achievements and contributions in the fields of agricultural research and agricultural education.

Senior appointments made during the year were Dr R. B. Dun as Deputy Director-General, Dr K. P. Sheridan as Assistant Director-General and Mr J. H. Ballard as Director of Foreign Aid Programmes.

During the year there were forty-seven officers engaged on overseas travel and twenty-four on overseas post-graduate study trainees; 10 trainees out of an overall strength of nineteen graduated from universities and colleges at the end of 1976. No trainees were recruited at the commencement of 1977 and the indications are that the system of traineeships as a means of sustaining the establishment of professional staff within the Department will very shortly disappear. The number of trainees currently attached to the Department is nine.

DEPARTMENTAL STAFF ESTABLISHMENT AS AT 30TH JUNE, 1977

Division/Branch	Professional					General and Ministerial			Admin. and Clerical	Total
	Res.	Ext.	Educ.	Admin.	Tot.	Reg.	Other	Tot.		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cent. Admin.	..	..	..	15	15	..	36	36	117	168
Ext. Services	2	40	..	14	56	..	117	117	75	248
Animal Ind.	86	128	..	27	241	984	238	1222	65	1 528
Dairying	15	37	..	13	65	..	77	77	10	152
Horticulture	30	35	..	18	83	151	15	166	16	265
Plant Ind.	83	62	..	21	166	23	20	43	17	226
Biol. and Chem. Inst.	94	..	..	8	102	..	102	102	10	214
Biometrical	13	..	..	2	15	..	1	1	6	22
Marketing and Economics	35	..	..	9	44	..	18	18	8	70
Research Services	7	8	..	39	54	..	574	574	44	672
R.G.B. & Nat. Herbarium	11	..	1	2	14	..	155	155	3	172
Agl. Educ.	1	..	41	7	49	..	126	126	22	197
	377	310	42	175	904	1 158	1 479	2 637	393	3 934

Explanatory notes:

- (1) Professional officers whose time is predominantly occupied on research projects and laboratory diagnostic services.
- (2) Professional officers whose time is predominantly occupied on extension to farmers.
- (3) Professional officers whose time is predominantly occupied on agricultural education.
- (4) Professional officers whose time is predominantly occupied on administrative or other activities.
- (6) General Division and ministerial staff whose time is predominantly occupied on regulatory activities.
- (7) Other General Division and ministerial staff.
- (8) Typists, office assistants, and clerical assistants are included in the General Division figures.
- (9) Only accounting machine operators, stenographers and male clerical positions are included in these figures.
- (10) Trainees and prickly pear casual staff are not included.

SAFETY

In 1972, on the recommendation of the Safety Officer, this Department set itself a target of reducing the injury frequency and severity rates by 50 per cent over the 5 years to 30th June, 1977. This target has all but been achieved.

In addition to reducing the injury frequency and severity rates the Department has been granted a rebate in Workers' Compensation Insurance premiums because of the low level of compensation claims and this has meant a saving in expenditure of many thousands of dollars.

The decrease in injury rate has been attributable to—

- (a) knowledge gained by management and supervisory staff from safety education courses conducted by the Safety Officer since 1972;
- (b) general awareness by management and supervisors that safe working conditions reduce accidents;
- (c) wider acceptance of protective clothing and safety equipment;
- (d) regular visits by the Safety Officer to the higher accident rate areas;
- (e) active part being played by safety committees and safety supervisors at the larger Departmental establishments.

Eleven courses were conducted by the Safety Officer during the year instructing staff on fire prevention and the identification and application of the various fire extinguishers on the different classes of fire. The emphasis was on fire prevention in laboratories and other high fire risk areas.

Future plans on safety include reduction of noise levels, introduction of a hearing conservation programme in noisy areas and the distribution of electrical test equipment among the Regions.

ORGANIZATION AND METHODS

During the year further progress was made with a survey of clerical duties at district veterinary offices. Finality of the survey has been delayed by staff shortages.

Other matters subject to examination during the year were procedures relating to payment of leave in advance and of leave loading, procedures relating to maintenance of salary rate records, procedures related to the preparation, storage and discharge of bills of sale and compilation of procedure statements for clerical officers at Regional offices and research stations.

An examination was made of filing indexes used in the Divisions of Horticulture and Extension Services, at the Regional Headquarters at Wagga and the district office at Bathurst. At each location new indexes were prepared based on the Department's uniform filing system.

PESTICIDES REGISTRATION SECTION

Unfortunately it has not been possible to introduce the new Pesticides Act into Parliament up to the present. It is expected that it will be introduced in the latter part of 1977.

The new legislation is being developed to ensure that adequate control can be exercised over pesticides in order that they might be effective and safe in use. The legislation will include registration of rodenticides, dairy sanitizers and detergents and plant growth regulators as well as insecticides, fungicides and herbicides covered under the present Act. Also it will exercise control over the use of pesticides as well as the sale.

MARKETING BOARDS AND POLLS

The Division of Marketing and Economics is responsible for the administration of the Marketing of Primary Products Act and in particular for the conduct of polls arising from that Act.

Marketing Boards in operation at the beginning of the year were the Barley, Central Coast (N.S.W.) Citrus, Eggs, Grain Sorghum, Lemon, Murray Valley Citrus, Oats, Oilseeds, Rice, Sheep Meats, Tobacco Leaf, Wine Grapes and Yellow Maize Marketing Boards.

Polls under the Marketing of Primary Products Act

Six polls were conducted during the year under this Act. These were:

- (1) Triennial election of five producers' representatives to the Rice Marketing Board (24th September, 1976). All representatives were elected unopposed.
- (2) Triennial election of five producers' representatives to the Egg Marketing Board (8th October, 1976). The election was contested in one electoral district and there were 527 voters.
- (3) A poll to include additional varieties of wine grapes under the control of the Wine Grapes Marketing Board (20th December, 1976). The poll lapsed because less than 60 per cent of the ballot papers despatched were received at the close of the Poll.
- (4) A by-election to fill a vacancy on the Lemon Marketing Board (7th March, 1977). The poll was contested and there were 167 voters.
- (5) A by-election to fill a vacancy on the Rice Marketing Board (28th April, 1977). The poll was contested and there were 506 voters.
- (6) Triennial Election of five producers' representatives to the Grain Sorghum Marketing Board (20th May, 1977). The election was contested and there were 2 353 voters.

The three-year term of office of the Sheep Meat Marketing Board expired on 1st November, 1976. However, a poll was not conducted because this Board has ceased to function and the triennial election of 5 producers' representatives has been deferred until further notice.

Assistance was given to the State Electoral Office concerning the conduct of a poll in September, 1976, to elect 4 producer representatives to the Grain Elevators Board of New South Wales. The State Electoral Commissioner is the Returning Officer for the election.

LEGAL BRANCH

Acts

The Branch was involved in work leading to enactment of the following legislation:

Department of Agriculture (Repeal) Act, 1976

This Act repealed the office of "Minister of Agriculture" and provided for the continuation of the Department of Agriculture.

Wheat Industry Stabilisation (Amendment) Act, 1976

The definition of "wheat products" was amended in line with the Commonwealth definition.

Dairy Industry (Amendment) Act, 1977

This Act removed the quotas on margarine and allowed the mixing of "dairy blend".

Meat Industry (Amendment) Act, 1977

This amendment gave the Metropolitan Meat Industry Board the power to trade in animals and animal products.

Egg Industry Stabilisation (Amendment) Act, 1977

This amendment provided for the reduction of the State Hen Quota at an early date and brought the provisions in the existing Act up to date.

Regulations, Proclamations and Notifications

During the year, work leading to the gazettal of thirty-five sets of regulations and by-laws, fifty-six proclamations, and forty-six notifications was undertaken.

Prosecutions

Two hundred and thirty-eight informations were prepared under Acts administered by the Department.

Registrations

Registrations effected during 1974-5 and 1975-6 are compared numerically as follows:

	1975-6	1976-7
Farm Produce Agents	284	251
Veterinary Surgeons	1 129	1 161

Arbitrations under the Agricultural Holdings Act, 1941

There were three matters which were referred to Agricultural Committees for arbitration pursuant to the provisions of this Act.

STAFF DEVELOPMENT

During the year the Staff Development Branch conducted 38 training courses for a total of 687 officers. Twenty of these courses were run outside the Sydney area.

The Branch also assisted:

- 150 officers to attend Public Service Board short courses;
- 113 officers to attend 44 professional conferences/seminars/workshops;
- 206 officers to study under the Study Assistance Grant Scheme;
- 16 Public Service Board part-time scholarship holders to undertake graduate/post-graduate studies.

In addition the Branch was invited to take part in eleven other courses run by Divisions and to assist in the planning of several other programmes.

During the year, the Staff Development Committee met on five occasions, the Committee's main function now being one of monitoring the programmes previously planned and organized. In June, 1977, the Committee was reconstituted and its charter modified to meet new Departmental requirements.

DIVISION OF EXTENSION SERVICES

FUNCTIONS

- Directs and co-ordinates the Department's extension services throughout the State's eight agricultural regions.
- Administers and maintains the Department's regional offices.
- Supports staff with extension methods training and the provision of audio/visual aids.
- Provides the publications and information services of the Department. These include editorial services and home garden inquiries.
- Promotes group extension activities and provides organizational help to the Agricultural Bureau.
- Conducts extension/research evaluation.
- Initiates extension/research liaison.
- Administers and provides professional staff for the Rural Youth Organization.

STAFF

Appointments and Severances

Appointments: Mr J. N. Potter, Chief, Division of Extension Services; Mrs R. J. Thearle, Extension Officer, Goulburn; Mr V. N. Gidley, Research/Extension Liaison Officer, Dubbo; Mr G. A. Rance, Regional Director of Extension, Wagga; Mr F. B. Sugden, Regional Publicity Officer, Orange; Mr K. Mattock, Regional Clerk, Orange; Miss J. Love, Extension Officer (Art/Display/Design); Miss J. Balcombe, Editorial Officer; Mr A. J. Ruhl, Field Assistant, Young. Mr D. G. Campbell, Editorial Officer.

Severances: Mr B. D. Ament, Chief, Division of Extension Services, retired; Mr R. C. Madsen, Regional Director of Extension, Wagga, retired; Mr S. J. Fawns, Clerk Class A, Goulburn, resigned; Mr J. C. Chaseling, Extension Officer (Rural Youth), Maitland, transferred to Training Officer, Government Printing Office; Mr R. J. Sidlow, Field Assistant, Griffith, retired; Mrs J. Free and Mr D. Austin, Part-time Editorial Officers, resigned; Mr B. A. Nelson, Extension Officer (Art/Display/Design), resigned; Mr J. F. M. Wilson, Research Liaison Officer (Science Writer), transferred to the Department of Consumer Affairs; Miss W. Battye, Extension Officer (Group Extension), Lismore, resigned.

Mr B. D. Ament retired as Chief of the Division of Extension Services on 19th August, 1976. Mr Ament joined the Department of Agriculture in 1934 as Assistant Agrostologist at Bathurst and was later District Agrostologist for western New South Wales with headquarters at Orange. After 3 years' war service, he became District Agronomist at Cooma and later at Orange. In 1953 he was appointed Regional Supervisor of Agriculture for the Western Agricultural Region. This position was later re-designated as Regional Director of Extension. In 1967 Mr Ament became Chief, Division of Extension Services. Mr Ament gave distinguished service as an Agronomist and later as an administrator of extension services. His period as Chief of the Division of Extension Services was distinguished by a much greater delegation of authority to Regional Directors of Extension and strengthening of the leadership in extension.

Mr R. C. Madsen retired as Regional Director of Extension, Southern Agricultural Region, on 26th January, 1977. Mr Madsen was appointed to the Department in 1938. Following war service, he was District Agronomist at Orange, Manager at Leeton Agricultural Research Station and then was appointed to the position of Regional Supervisor of Agriculture at Wagga in 1953. The position was later re-designated as Regional Director of Extension. Mr Madsen was the first Regional Supervisor of Agriculture to be appointed. During his long service in the Department he was responsible for many innovations, especially in the organization of extension services.

Official Overseas Visits

Mr N. W. Vane, Regional Director of Extension, Mid Coast and Hunter Region, left in May, 1977, for Sri Lanka to lead a team from the Department of Agriculture in assisting the Sri Lanka government to implement an agricultural development project. He will return in August, 1977.

Mr D. T. Fardy, Extension Research Officer, completed a study tour of the United States and United Kingdom from 16th April, 1977, to 5th June, 1977. The tour, which was funded by A.E.S.G., aimed at investigating extension research, evaluation and research on extension publications and other forms of extension communications.

Committees

Officers of the Division served on a wide range of committees. These included:

- Rural Advisory Committee.
- M.I.A. Fruit Fly Campaign Committee.
- Irrigation Research and Extension Committee.
- Land and Water Utilization Committee.
- Agricultural Bureau Executive Council.
- Rural Youth State Council.
- Yass Valley Organization.
- N.S.W. Tobacco Advisory Council.
- Regional Interdepartmental Committees on Rural Adjustment.
- A number of agricultural research and extension committees at regional level.

Staff Training

Developments in staff training include the organization of workshops on spoken and written communication for research and extension officers and P.P. Board veterinary inspectors. Most of these workshops are described more fully elsewhere.

Training and Assistance to Overseas Visitors

Division of Extension Services staff were involved in the organization and training of many overseas visitors. The purpose of these visits ranged from training to conference representations and study tours.

The Division was also involved in the organization, planning and teaching of the International Training Course in Agricultural Extension for International Fellows studying in Australia. This course was sponsored by the Australian Government under the Colombo Plan, the Special Commonwealth African Assistance Plan, the South Pacific Aid Programme, and the Australia Papua New Guinea Education and Training Scheme, and was arranged by the Department of Foreign Affairs, Australian Development Assistance Bureau.

NEW DEVELOPMENTS

Re-structuring of the Division of Extension Services

The Division of Extension Services reviewed its professional staff structure, taking into account its continuing and general responsibility in extension work, and the need to service various rural groups, with special responsibility to the Rural Youth Organization of N.S.W. and the Agricultural Bureau of N.S.W. Following the approval of the Public Service Board, the Division reorganized its staff as from 1st June, 1977.

Essentially this involved deletion of the position of Assistant Principal Extension Officer (Groups), five positions of Special Extension Officer, seven positions of Regional Extension Officer (Rural Youth), twenty-two positions of Extension Officer (Rural Youth) and five positions of Extension Officer (Group Extension). These deletions were offset by the creation of the position of Assistant Principal Extension Officer, seven positions of Regional Extension Officer and twenty-three positions of Extension Officer.

DIVISION OF ANIMAL INDUSTRY

FUNCTIONS

The Division of Animal Industry is responsible for research, extension and regulatory control relating to livestock production and health. Research is conducted into diseases of all classes of commercial livestock and into the breeding, nutrition and management of sheep, beef cattle, pigs, poultry and bees, together with nutrition of dairy cattle. Noxious animals research is also undertaken.

Extension is directed at educating stockowners in procedures aimed at improving efficiency of reproduction, management and nutrition of sheep, beef cattle, pigs, poultry, Angora goats and bees, together with methods of preventing and controlling disease in these species and also dairy cattle. Regulatory control is exercised over scheduled diseases of livestock and bees, the identification of livestock and the control of noxious animals and insects.

The Division is responsible for inspection of meat for local consumption, administration of Government drought relief, travelling stock reserves and public watering places and the registration of stock foods and medicines. On behalf of the Australian Government, the Division administers the sections of the Quarantine Act relating to the import and export of animals and animal products.

STAFF

Staff Changes

The following officers retired or resigned during the year:

Mr J. C. Keast (Director of Veterinary Research); Mr J. E. Cantello (District Veterinary Officer, Bourke); Mr E. G. Lowe (Veterinary Inspector, Coonamble); Mr I. G. Eade (Veterinary Officer, Wentworth); Mr K. J. Armstrong (Veterinary Officer, Narrabri); Mr P. H. Savage (Livestock Officer, Fleece Measurement Service) and Mr A. J. Dunne (Livestock Officer, Sheep and Wool).

Mr J. C. Keast retired after 41 years service in this Department of which the last 17 were as Director of Veterinary Research. During that time he was associated with many important research projects and initiated a number of joint projects with other organizations.

Mr J. E. Cantello's 35 years' association with the Department included service as a veterinary inspector and later as a district veterinary officer. Most of the time he was in the western division of the State.

The following appointments were made:

Dr P. J. Mylrea to Director of Veterinary Research; Mr L. G. Williams to Principal Veterinary Officer (Extension); Mr W. A. Mayger to Principal Veterinary Officer (Meat Inspection) vice Mr P. Brydon who assumed responsibility for Pesticide Residues in relation to the Stock (Chemical Residues Act); Mr J. F. Archer to Assistant Principal Veterinary Officer (Meat Inspection); Mr R. M. Weaver to Assistant Principal Veterinary Officer (Disease Control); Mr A. R. Clark to Assistant Principal Livestock Officer (Sheep and Wool); Mr G. A. Wise to District Veterinary Officer, Narrandera; Mr D. T. Jones to District Veterinary Officer, Bourke; Mr J. G. Thorpe to Veterinary Officer (Meat Inspection); Mr V. H. Craig to Veterinary Officer, Wentworth; Mr I. J. Roth to Veterinary Officer, Bourke; Mr P. A. Harper to Veterinary Research Officer, Glenfield; Mr C. A. Bourke to Veterinary Inspector, Coonamble.

Mr I. Lewis was appointed Principal Advisory Officer to the Board of Tick Control at Lismore. Mr K. W. McDougall was appointed Officer-In-Charge of the Board of Tick Control Chemistry Laboratory vice Mr J. H. P. Dingle who had occupied this post for a number of years.

Overseas Visits and Attendance at Important Conferences

Dr A. R. Jackson, Officer-In-Charge of the Colin Blumer District Veterinary Laboratory, Armidale, was appointed for 12 months as Australian/Asian Universities Co-operation Scheme fellow at the Universiti Pertanian Malaysia near Kuala Lumpur. He serves as Associate Professor of Veterinary Pathology in the Faculty of Veterinary Medicine and Animal Science.

Mr F. W. Evans, Assistant Principal Veterinary Officer (Tuberculosis and Brucellosis), attended a seminar on bovine tuberculosis in New Zealand and presented a paper on the progress of the eradication of tuberculosis in New South Wales.

Mr B. R. White, Assistant Principal Livestock Officer (Apiculture), visited New Zealand to study comb section, honey production and clover honey production.

Mr C. Hall, Special Veterinary Research Officer, attended the International Congress of Entomology in Washington, U.S.A., and delivered a paper on microclimate studies of the fleece in relation to blowfly strike. He also visited Europe.

Mr A. P. Hunter, Regional Veterinary Research Officer, made a private visit to New Zealand to present a paper on nutritional factors affecting fertility of dairy cattle to the New Zealand Veterinary Association Conference at Christchurch.

Mr A. C. Bryce, Veterinary Officer, visited the United Kingdom and the Republic of Ireland to accompany an importation of horses by air. While there he visited the University of Cambridge to investigate developments in embryo storage and transfer.

Mr R. E. Freer, District Livestock Officer (Beef Cattle), visited Sri Lanka with a Departmental team to assist with the implementation of an agricultural development project on behalf of the Australian Development Assistance Bureau.

Conferences: The Chairman of the Board of Tick Control, the Principal Advisory Officer and two Research Officers attended a workshop on the acaricide resistance problem held at the CSIRO Long Pocket Laboratories, Brisbane.

Mr D. H. Mumford, Chief, Division of Animal Industry, was the official Department of Agriculture representative at the Annual Conferences of the Australian Veterinary Association held in Perth. The Conference was also attended by one Special Veterinary Officer and two Veterinary Inspectors.

Mrs C. Adams, Research Officer, attended the International Conference on Mammalian Reproduction held in Canberra.

The Symposium on the promotion and marketing of pig meat held at Bendigo, Victoria, was attended by four officers including the Principal Livestock Officer (Pigs).

Committees

The Division was represented on the following more prominent committees:

Animal Production Committee and a number of its Subcommittees.

Animal Health Committees and a number of its Subcommittees.

Board of Veterinary Surgeons.

Stock Medicines Board.

N.S.W. Meat Industry Authority.

Dairy Industry Artificial Breeding Advisory Board.

Poisons Advisory Committee.

Cattle Tick Control Commission.

Veterinary Public Health Committee of the National Health and Medical Research Council.

Standing Committee on Drought Relief.

Australian Plague Locust Commission.

Pastures Protection Board Council of Advice.

State Inter-Departmental Committee on Zoonoses.

Poultry Advisory Board.

Chicken Meat Council.

State Bushfire and Flood Relief Committees.

Staff Training

Training of the Division's research and extension staff is reported elsewhere in this report.

For meat inspectors, lectures and demonstrations were held at the annual conference and at regional conferences. One conference was held for Senior Meat Inspectors. A number of Inspectors attended other training courses.

Forty-seven newly appointed field assistants (brucellosis) attended training courses on the brucellosis eradication campaign held in the Grafton and Armidale district veterinary officer areas.

Assistance to Overseas Countries

An international training course in animal quarantine procedures was conducted by the Department for the Australian Development Assistance Bureau. The Principal Veterinary Officer (Quarantine) acted as director of studies for the N.S.W. segment. Seventeen overseas personnel attended. Also six Filipino Veterinarians studied quarantine procedures in Sydney and Newcastle.

An international training course in poultry husbandry for twenty-six overseas fellows from nineteen countries was organized by the Australian Development Assistance Agency in liaison with State Departments of Agriculture. The New South Wales segment of the course was conducted at the Seven Hills Poultry Research Station, the Glenfield Veterinary Research Station and in the commercial poultry industry.

Laboratory experience and training was also given to veterinarians from Indonesia and veterinary students from India.

Two students on secondment from the New Hebrides were trained in the practical aspects of meat inspection at Grafton abattoir by officers of the State Meat Inspection Service.

A study tour was arranged for the Korean livestock manager counterpart employed on the Australian sheep project in South Korea. Assistance was also provided to the Australian Development Assistance Agency on technical aspects of Australian aid projects in South Korea and India.

NEW DEVELOPMENTS

State Meat Inspection Service: As more slaughterhouses came under the control of the State Meat Inspection Service the need for enabling more effective administration was met. The administrative body was transferred from the Homebush Bay Abattoir to the State Office Block. Additional clerical staff were appointed and three new senior supervisor positions were filled with appointees stationed at Wagga, Goulburn and Grafton.

Marketing: Two new developments were:

- Progress towards introduction of classification of beef, sheep and pig carcasses. Systems were put into operation in a number of New South Wales abattoirs on a trial basis.
- Start of the new Livestock Market Reporting Service for cattle and sheep. This incorporated standard live animal descriptions developed in conjunction with the Victorian Department of Agriculture.

Brucellosis Eradication Campaign: The commencement of the test and slaughter phase of the brucellosis eradication campaign was delayed due to the uncertainty of future funding until December, 1976, when pilot activity commenced in the northern part of the State. The National Brucellosis Compensation Scheme became operative as from 1st December, 1976, in New South Wales with the Commonwealth contributing 75 per cent of the cost and the State Cattle Compensation Fund the remaining 25 per cent.

A national disease recording system is being implemented and the first of five mini-computers for New South Wales was installed at the Wollongbar District Veterinary Laboratory for use in conjunction with telex. This will enable fast relaying of brucellosis test results to owners and field staff and will enhance the efficiency of the overall programme.

DIVISION OF DAIRYING

FUNCTIONS

The Division of Dairying has three functions: extension, regulatory, and research.

It is responsible for guidance to the industry in all phases of farm production and product manufacture to the point of marketing.

Areas for improvement through extension

- Animal husbandry techniques.
- Stock quality and production through its herd improvement programme.
- Milking shed management and machine efficiency.
- Farm business management.
- Production of high-quality milk, cream and manufactured dairy products.

Regulatory

Responsible for administering the Dairy Industry Act and certain provisions of the New South Wales Pure Food Act under which powers are exercised to:

- Safeguard farmers' interests.
- Enforce prescribed product standards.
- Ensure satisfactory standards of hygiene at farm and factory.
- Examine and issue certificates of competency for factory personnel.
- Register dairy produce factories and stores.
- Check efficiency of testers and graders of milk and cream.

Research

The carrying out of research on new and existing dairy foods, sanitizers, milking machines, mastitis control, herd improvement, nutrition and genetics.

STAFF

Vacancies

Vacancies exist for the positions of Deputy Chief, Principal Dairy Officer (Milk Products), Assistant Principal Dairy Officer (Butter) and Principal Dairy Officer (Research). The filling of these positions has been delayed pending deliberations concerning the possible integration of the Division of Dairying with the Dairy Industry Authority.

Severance and Appointments

Dr M. B. Barkley, Mrs A. M. Wheeler and Miss J. McPherson were appointed as Dairy Research Officers, Dairy Research Centre, Richmond. Dr Barkley is engaged in research work on bacterial flora of milk residues on farm equipment, Mrs Wheeler in research on dairy hygiene, dairy detergents and residues, and Miss McPherson is attached to the Dairy Foods group.

Mr D. Radford, Dairy Officer, Dairy Research Centre, was seconded to the University of N.S.W. from September, 1976, to June, 1977, to assist in the development of a pilot-scale continuous fermentation process for the set to drain section of cheddar cheese manufacture.

Overseas Visits and Conferences

Officers of the Division participated in the following Conferences:

- Dairy Exports Standards Conference—Melbourne.

The Conference was to establish criteria, within Australia, for sensory grading, techniques for dairy products and the procedures to be adopted in achieving these standards, particularly in relation to interstate movements of butter and cheese.

- Packaging of Dairy Products Seminar and Workshop—Melbourne University.

The aim of the Conference was to make industry aware of its shortcomings in the marketing and packaging of dairy products and to stimulate it to survey wholesale, retail and consumer needs with a view to making improvements in these areas.

- Milk Protein Workshop—Tanunda, South Australia.

Organized by the South Australian Department of Agriculture and Fisheries under the auspices of Standing Committee on Agriculture and centered on the needs and future of milk protein research.

- Australian Society of Dairy Technology Federal Conference and Council Meeting, Perth.

- Seminar on Alternative Uses for Manufactured Milk—Melbourne.

Organized by the Victorian Division of the Australian Society of Dairy Technology and concerning diversification in milk product manufacture.

- Working Party—Dairy Industry Marketing Arrangements.

Established by the Australian Agricultural Council to identify and clarify aspects of the Industries Assistance Commission Report on Dairy Industry Marketing Arrangements of September, 1976. The Working Party submitted reports to the Australian Agricultural Council which formed the basis of legislation to introduce Stage I of the arrangements on 1st July, 1977.

Committees

The Division was represented on the following more significant Committees.

- Artificial Breeding Advisory Board—Dairy Industry Authority.
- Technical sub-committees of Standing Committee of Agriculture.
- Standards Association of Australian Dairy Committees and associated subcommittees.
- Herd Improvement and Herd Recording Committee.
- Dairy Husbandry Research Foundation—University of Sydney.
- Breed Societies—Five societies and Registered Dairy Cattle Association.
- Technical Advisory Committee—Australian Development Assistance Agency Projects, India, Pakistan and Sri Lanka.
- Society of Dairy Technology—State and Federal Committees.
- National Dairy Industry Processing Committee (N.S.W. Branch) Training of industry personnel.
- International Training Course—Australian Development Assistance Bureau—sub-committees on Animal Husbandry and Dairy Technology.
- Development Committee for butter and butter products, Australian Dairy Corporation.

Staff Training

Officers of the Division attended courses on computer programming and systems analysis to enable them to more effectively converse with computer programming experts and more efficiently plan co-ordination of the artificial breeding and herd recording services and implementation of the Sire Evaluation Plan.

One officer attended a continuous-butter-making school at the Gilbert Chandler Institute of Dairy Technology at Werribee.

Officers attended administration courses in executive and middle management and communication.

Assistance to Overseas Personnel

The Division assisted the Australian Development Assistance Agency with the training of personnel from developing countries in the Pacific, S.E. Asia, India and Africa in attending courses in animal husbandry and dairy technology, each of two and a half months.

NEW DEVELOPMENTS

Diversification in Milk Product Manufacture

There has been a continuing trend in New South Wales towards milk products other than the traditional cheddar cheese, butter and skim milk powder. Activities within the Milk Product Section of the Division have been progressively widened to include such products as non-cheddar varieties of cheese, cultured milk products and dairy desserts. Also, testing programmes organized for the Dairy Product Quality Assurance Test Unit at the Dairy Research Centre, Richmond, have been weighted more towards the analysis of these "new" products.

Farmer Sampling

The use of farmer sampling as an alternative system of herd recording was introduced on a trial basis in the Lismore and Casino dairying districts. The cost of the normal system of herd recording had increased to such an extent that many farmers, particularly in those areas where manufactured milk production provided the main source of farm income, were unable to afford the service. A lower cost system was required so that these farmers could retain herd recording as a management tool. The results of the trial would indicate that the system would be extended, particularly in other areas of the north coast during 1977-8.

Herd Recorders Working Conditions

With the elimination of the optical character reader as a means of collecting herd recording data, a herd recorder's workload will now be determined by the number of hours worked on a monthly basis and not on the previously operated system where the recording of seventy-two cows constituted a normal day's work. This change, together with a further extension of central testing, will enable the cost of recording to the farmer to be contained.

Sire Evaluation Plan

This plan commenced on the 1st July, 1976. Some 85 farmers have been contracted to mate at least 3 of their herds to young, unproven sires of the Friesian and A.I.S. breeds specially selected for their potential as superior sires. Two groups of bulls have been used in the first year of operation. Almost 300 cows of the Friesian breed and some 150 cows of the A.I.S. breed have been mated to each of the 25 Friesian and 6 A.I.S. bulls. The first progeny of the first group of bulls are being born as the third group of bulls enter service and use.

Incentives to participate in the plan have been provided in the form of reduced herd recording fees and rebates on semen used under the plan. The plan did not become operable for the Jersey or Guernsey breeds due to insufficient cows being offered by farmers.

Information on Livestock Numbers and Production at Departmental Institutions

Stud activities at Yanco Agricultural College and C. B. Alexander College (Tocal) have continued under the supervision of the Division.

At both Colleges the dairy sections provide a valuable means of providing extensive practical experience for students.

During the year, the A.I.S. Stud at C. B. Alexander College was bolstered with the introduction of thirteen cows from the Berry Training Farm. These animals have settled in well, and will provide valuable bloodlines to the College herd.

Sale of Departmental stud cattle has diminished greatly. A notable sale was a Friesian bull from C. B. Alexander Agricultural College which was sold under auction at the Friesian Cattle Club's Fanfare Sale for \$650.

A donation of eight head of Friesian cattle was made to the Society For Those Who Have Less from the C. B. Alexander College herd. The cattle will be sent to India.

Sales

	Head	\$
C. B. Alexander Agricultural College (Friesian)	6	1,265
C. B. Alexander Agricultural College (A.I.S.)	1	135
		\$1,400

Show Exhibits

Both Tocal and Yanco Colleges exhibited teams of cattle at their respective local shows. No teams of cattle were exhibited at the R.A.S. Royal Easter Show.

DIVISION OF HORTICULTURE

FUNCTIONS

The Division of Horticulture is concerned with preventing and controlling damage by plant pests and diseases, and the production, marketing and export of fruit and vegetables. Its research, extension and regulatory services assist those industries involved in the growing, post-harvest handling and processing of fruit and vegetable crops. In the administration of plant quarantine the full range of agricultural pests and diseases is covered and, with inspection and certification of exports, grains as well as horticultural products are dealt with.

Research

Research horticulturists are located at research stations and laboratories on the north coast, central coast, northern tablelands, central tablelands and in the County of Cumberland as well as in the central-west, Murrumbidgee and Lower Murray irrigation areas. A comprehensive research programme relating to plant improvement, establishment/management, production/harvesting, storage/disinfestation/product quality and economics is being conducted with respect to fruit, vegetables and, to lesser degree, ornamental crops.

Extension

Extension horticulturists are located in the major fruit and vegetable production areas of the State to assist primary producers obtain the maximum benefit from their resources by adopting improved techniques. Extension horticulturists are the link between research and commercial practices. They also assist in the prevention and control of plant pests and diseases as well as being responsible for the presentation of statistical information and crop forecasts.

Regulatory

Inspectors (Plant Diseases Act) enforce legislation concerned with the prevention and control of plant pests and diseases; the grading, packaging and labelling of fresh fruits/vegetables; the licensing of potato growers, nurserymen and resellers of nursery stock; and maintaining fruit/vegetable quality standards. As agents for the Commonwealth Government, the Export and Import Branch of this Division administers the plant quarantine provisions of the Quarantine Act and regulations relating to the export of fresh fruit, vegetables, plants, seeds, flour, wheat and other grains under the Commerce (Trade Descriptions) Act.

STAFF

General

Owing to limitations on staffing, vegetable extension has been restricted. A research horticulturist position at Yanco also remains vacant.

Severances and Appointments

Mr A. H. Skepper, Principal Horticulturist (Regulatory), retired in October, 1976, after almost 40 years of service with the Division of Horticulture, including 17 years as the Senior Horticulturist on the M.I.A. Mr Skepper's legalistic mind made him well suited to the regulatory position he held for 10 years prior to his retirement.

The position of Principal Horticulturist (Regulatory) was filled by the appointment of Mr J. W. Turpin, formerly Assistant Principal Horticulturist (Regulatory) which latter position was filled by Mr A. Catley, formerly Scientific Officer (Regulatory).

Mr E. J. Fuller, Horticultural Packing Adviser, retired in February, 1977.

Mr D. Leggo, formerly Principal Horticulturist (Research), was appointed to the position of Regional Director of Research, Wollongbar.

Overseas Visits and Conferences

Mr G. R. Gregory, Chief, Division of Horticulture, attended a Council meeting of the International Society for Horticultural Science and two international symposia in Italy.

Mr J. K. Long, Deputy Chief, resumed duty after spending five months on secondment to the Commonwealth Department of Primary Industry as Australian Fruit Officer, London.

Mr J. H. Duncan, Principal Horticulturist (Citrus), attended the International Citrus Congress in Florida. While overseas he studied developments in production of citrus fruits in Arizona, Texas, California and Mexico.

Mr J. B. Sumeghy, Special Research Horticulturist, visited the U.S.A. to study mechanized production of processed tomatoes and development of tomato varieties suitable for both processing and the fresh market.

Mr R. J. Hutton, Research Horticulturist, studied developments in intensive fruit culture and mechanical harvesting in the U.K., Europe and U.S.A. and attended a high density planting symposium at Wye College, Kent.

Committees

The Division was represented on the following more significant committees:

- XXth International Horticultural Congress Organizing Committee
- Standing Committee on Agriculture Horticulture Committee
 - Fruit Variety Foundation Sub Committee
 - Fresh Fruit Disinfestation Sub Committee
 - Fruit and Vegetable Post Harvest Research Sub Committee
 - Grape Advisory Sub Committee
- CSIRO Vine Improvement Research Committee
- Commonwealth Dried Fruits Research Committee
- M.I.A. Irrigation Research and Extension Committee
 - M.I.A. Fruit Fly Sub Committee
- Central Coast Agricultural Research and Extension Committee
- Gosford Horticultural Post Harvest Laboratory Research Advisory Committee
- Banana Marketing Control Committee (N.S.W.)
- Horticultural Stock and Nurseries Act Advisory Committee

Staff Training

The fourth in-service training course of 12 weeks duration was conducted for 10 newly appointed inspectors (Plant Diseases Act). These courses have been beneficial in increasing the confidence and competence of inspectors and allowing them to be more usefully employed on the wide range of inspectorial duties undertaken by the Export and Import Branch.

A middle management course was conducted by the Staff Development Section specially for supervising inspectors (Plant Diseases Act). A recommendation from this course has resulted in bi-annual meetings of supervisors with professional regulatory officers of the Division to discuss staff management and work procedures.

Assistance to Overseas Personnel

The Division of Horticulture has assisted the Australian Development Assistance Agency in the conduct of a number of training programmes with accent upon the production of tropical fruits and vegetable crops.

DIVISION OF PLANT INDUSTRY

FUNCTIONS

The Division of Plant Industry is involved mainly in the broad fields of agromomic research and extension. The Division also administers the Agricultural Seeds Act and for this purpose has a small regulatory staff of four inspectors, a seeds laboratory and a staff of seeds analysts.

The Division is responsible for research and extension within the whole range of field crops and pastures, fodder conservation, seed production, weed control, irrigation and cloud seeding.

The Prickly Pear Destruction Commission also functions within the administration of the Division but the Commission presents a separate report.

STAFF

Appointments and Severences

Dr K. P. Sheridan, Director of Agronomy Research, was appointed Chief, Division of Plant Industry from 6th July, 1976, and was subsequently promoted to Assistant Director-General from 23rd February, 1977. Dr S. G. Grimmett, formerly Regional Director of Research, Wollongbar Agricultural Research Centre, was promoted to Chief, Division of Plant Industry from 26th April, 1977.

Mr W. T. Atkinson, Principal Agronomist (Pastures), retired on 13th April, 1977, after 43 years in the Service. Mr Atkinson had been well known among pasture research and extension workers throughout Australia for many years.

Mr M. H. Walker, Assistant Principal Agronomist (Pastures), died tragically in the Granville train disaster on 18th January, 1977. A dedicated agronomist, Mr Walker joined the Department in 1952. He did pasture research at Glen Innes Agricultural Research Station for 9 years until his appointment to Head Office, where he remained until his death.

Overseas Visits and Conferences

Mr D. E. Toohey, Principal Agronomist (Irrigation), visited the United States and the Netherlands for 8 weeks to investigate developments in sprinkler irrigation, drainage and water quality. The tour was financed by the Australian Extension Services Grant.

Mr E. K. Leggett, Principal Officer (Remote Sensing), visited the United States and Canada to undertake analysis of satellite computer tapes from a research project at Lake Tandou in western New South Wales. He also contacted workers in remote sensing at several centres.

Mr P. Wallens, District Agronomist, Inverell, visited the United States to study machinery and techniques used in minimum cultivation.

Major conferences attended included the third SABRAO (Society for the Advancement of Breeding Researches in Asia and Oceania) Congress (ten agronomists), the Australian Oilseed and Grain Legumes Conference (eight agronomists), and Seeds Conference (four agronomists).

Committees

Some of the more important committees on which officers of the Division represent the Department are:

- Commonwealth and States Plant Production Committee.
- Co-ordinating Committee for Seed Certification.
- Chief Seed Testing and Regulatory Officers Committee.
- Australian Weeds Committee.
- Noxious Plants Advisory Committee.
- N.S.W. Standing Advisory Committee on Wheat.
- Catchment Areas Protection Board.
- Hunter Valley Conservation Trust.
- N.S.W. and Central Tobacco Advisory Committee.
- Australian Wheat Index Committee.

Staff Training

The most important aspect of scientific research training is post-graduate research aimed at the presentation of theses for higher degrees. In this regard the following Divisional figures for 1976-7 are of interest.

Officers undertaking post-doctoral studies	..	..	..	1
Number of officers granted doctorates	.	..	..	2
Officers undertaking doctoral studies	..	..	..	8
Officers granted masterates	..	..	..	5
Officers undertaking masterate studies	..	..	..	22

No district agronomists were available for the 1976 Graduate Diploma in Extension Course but two are attending in 1977. One district agronomist is undertaking a Diploma in Agricultural Science in Rangeland Management at the University of New England during 1977.

One district agronomist completed an external degree course and three continued with studies towards degrees.

NEW DEVELOPMENTS

A Remote Sensing Section was created in the Division of Plant Industry during the year, the first such section in any Australian Department of Agriculture. The section is concerned with research and development and the use of aerial and satellite sensing for monitoring events of agricultural significance.

During the year those research officers attached to the Division of Research Services and located at Wagga and Tamworth and who were undertaking research into matters of agronomic interest, were transferred to the Division of Plant Industry to ensure better co-ordination and development of agronomy research.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE

FUNCTIONS

The Institute has three Scientific Branches—Biology, Chemistry and Entomology and a Secretariat which provides managerial and clerical support.

Biology Branch consists of plant pathologists and legume bacteriologists. Plant pathologists carry out research on diseases of plants, diagnose plant diseases and advise officers of other Divisions and primary producers on plant disease control. They also advise the State and Commonwealth on plant quarantine. The Branch Electron Microscope Unit, concerned with virus and mycoplasma disease of plants, is also a service unit to the rest of the Department.

Legume bacteriologists do research on establishment of nodule producing bacteria in the soil and on the plant. They distribute cultures of these bacteria to other research centres and industrial organizations and advise field officers of the Department on the most efficient methods of legume inoculation. The Australian Inoculant Research and Control Service operates a quality control service for commercial legume inoculants available throughout Australia to ensure the maintenance of high nitrogen fixing ability.

Chemistry Branch gives technical advice on the chemical aspects of plant production and related industries. The Branch has eight sections: cereals; oils and regulatory; pesticides; plant nutrition; plant and soil analysis; physical chemistry; phytochemistry, and soils and water.

Each of these groups conducts research, and provides recommendations and analytical information to the Department's extension officers who advise farmers on their day-to-day problems. Some of the sections have the added responsibility of seeing that products such as fertilizers, pesticides and cereals are of proper standard and safe for both farmers and consumers.

Entomology Branch conducts research on improved pest control methods which increase agricultural production without posing residue and environmental problems. Regular advice is given on pest problems, control measures and identification of pests within the Department, to primary producers and the public. These extension, service and regulatory functions are mainly dependent upon information provided by Entomology Branch research.

STAFF

Appointments and Severances

- Dr H. S. Saini, Chemist, Agricultural Research Institute, Wagga, to work on the chemistry of oil seed crops and other alternative crops to wheat;
- Dr D. R. Baigent, Chemist, Agricultural Research Centre, Wollongbar, pasture and field crop development;
- Mr P. J. Walters, Entomologist, vegetable pests and more recently exotic lucerne aphids;
- Mr P. B. Hughes, Entomologist, insecticide resistance in sheep blow-fly;
- Mr M. J. Fletcher, Entomologist, taxonomy of insect pests.

The transfer of the following five Chemists from the Division of Research Services to Chemistry Branch in early 1977, will assist in co-ordinating some of the chemical problems throughout the state—

- Dr I. C. R. Holford, Senior Research Scientist, Agricultural Research Centre, Tamworth;
- Mr M. Glennie-Holmes, Senior Chemist, Agricultural Research Institute, Wagga;
- Mr G. D. Batten, Chemist, Agricultural Research Institute, Wagga;
- Mr G. J. Osborne, Chemist, Agricultural Research Institute, Wagga;
- Mr R. J. Wreczycki, Chemist, Agricultural Research Institute, Wagga.

Other transfers included—

- Mr N. Ahmed, Chemist from the Dairy Research Centre, Richmond, to the Institute Pesticides Section;
- Mr P. Bacon, Research Horticulturalist as Chemist, Agricultural Research Centre, Yanco;
- Mr A. W. Hudson, Research Agronomist, as Chemist, Rydalmere.

Dr D. K. O'Neill, Director of Chemistry, retired on 9th June, 1977, after 41 years' service.

Dr O'Neill joined the Chemistry Branch in 1946 following employment with the Department of Education and the Ministry of Munitions. Apart from his latter years of service as a scientific leader and administrator, Dr O'Neill specialized in the chemistry/physical of fungicides and pesticides.

From 1954 to 1960, he was seconded to the University of N.S.W. to work on physico-chemical problems associated with cattle dip formulations including DDT. This work was a precursor to the initiation in 1956 of the major cattle tick eradication programme in northeastern New South Wales. While at the University of N.S.W. he gained his M.Sc.

On returning to Rydalmere, with the phasing out of DDT in the dipping programme, he commenced work on other pesticides formulations and was awarded his Ph.D. in 1963.

Dr O'Neill was appointed Chief Chemist in 1975 and subsequently Director of Chemistry following re-organization of the administration of the Institute later that year.

Dr T. B. Kiely, Special Plant Pathologist, Horticultural Research Station, Gosford, retired on 25th February, 1977, after 39 years' service.

During his career, most of which was spent in the Gosford District of New South Wales, Dr Kiely carried out research and other activities on diseases of citrus, passionfruit and vegetables. In 1949, he was awarded the degree of Doctor of Science in Agriculture by the University of Sydney for his research on the Black Spot Disease of Citrus. This research clarified the etiology and epiphytology of the disease and laid the basis of a successful fungicidal control programme.

As a result of his world standing in citrus pathology, Dr Kiely has acted as adviser to representatives of overseas governments and private industry. As a Colombo Plan Research Fellow, he inquired into the nature and cause of decline of citrus plantings in Sri Lanka, an investigation which enabled the authorities in that country to plan the rehabilitation of the industry.

Dr M. F. Redies, Senior Chemist—retired 19th April, 1977.
Mr N. Lloyd, Senior Entomologist—retired 12th October, 1976.
Mr D. M. Wallis, Chemist—resigned 12th November, 1976.
Mr N. Roxburgh, Entomologist—resigned 3rd August, 1976.
Mr R. Chesterfield, Chemist—resigned 10th December, 1976.
Mr K. Swansborough, Chemist—resigned 20th June, 1977.

Overseas Visits and Conferences

Dr G. Evans, Director of Biology, spent two months in Pakistan undertaking a consultancy with the Food and Agriculture Organization on the cotton research programme in that country.

Dr N. G. Nair, Senior Research Scientist, visited Kenya for three weeks at the request of the United Nations International Trade Centre, to advise the Government of Kenya External Trade Authority on the production of mushroom spawn.

Mr J. Walker, Senior Research Scientist, spent 2 weeks carrying out a plant disease survey of Norfolk Island, which will lead to the preparation of a fungus and disease list for the Island.

Mr A. L. Bertus, Special Plant Pathologist, attended the Australian Seeds Research Conference at Tamworth in April.

The Director of Biology, Dr N. G. Nair, Senior Research Scientist, and Mr R. W. McLeod, Special Plant Pathologist, attended the 6th Mushroom Industry Short Course in Sydney in July.

Mrs P. Barkley, Senior Research Scientist, attended the Australian Nurseryman's Association Biological Control Seminar in Hobart in March.

Dr G. J. Shanahan, Principal Entomologist, attended the XV International Congress of Entomology at Washington, U.S.A., in August, 1976.

Mr L. R. Greenup, Senior Entomologist, visited a number of research institutes and chemical companies in Europe, United Kingdom and U.S.A., August–October, 1976, to study insecticides and insecticide resistance in heliothis.

Mr Casimir and Mr L. Tuart, Entomologist, attended the Conference of the Aerial Agricultural Association of Australia at Port Macquarie, May, 1977.

Committees

Some of the more important Committees on which officers of the Institute represented the Department are—

- Ornamental Horticultural Advisory Committee;
- Standards Association of Australia Scientific Glassware;
- Organizing Mycology Section, 13th International Botanic Congress, Sydney, 1981;
- International Commission on Mushroom Science;
- International Organization of Citrus Virologists;
- International Bean Rust Committee;
- State Wheat Improvement Committee;
- Premium Wheat Growers Advisory Committee;
- N.S.W. Standing Advisory Committee on Wheat;
- Royal Australian Chemical Institute Cereal Chemistry Division Committee;
- N.S.W. Uniform Quality Testing (Wheat);
- Australian Plague Locust Commission;
- Commonwealth/States Committee—Revision of Pilots' Chemical Rating Manual.

Assistance to Overseas Personnel

- Four weeks intensive training was provided for an Indonesian technical officer to acquire new skills and techniques in analytical procedures in Chemistry Branch;
- A Samoan technical officer was also given three months training in atomic absorption spectrophotometric technique;

A number of distinguished overseas scientists visited the Institute during the year for varying periods including—

- The Agricultural Attache of the U.S.S.R. Embassy to discuss soil analysis techniques;
- Dr D. W. Immelman, Chief Director, Department of Agricultural Technical Services, South Africa, for discussion on agricultural research management;
- Two Scientists from the U.S.S.R.—grain storage problems;
- Professor R. M. Peterson, University of Knoxville, Tennessee, U.S.A.—identification of coral fungi;
- Professor K. Baker, University of California, U.S.A., and Dr P. J. Shipton, North of Scotland College of Agriculture, spent six months working in the Institute's Biology Branch.

NEW DEVELOPMENTS

A comprehensive report by a Planning and Co-ordinating Committee, comprising officers from the Public Service Board, Public Works Department, the Institute and Departmental Executive on the proposed improvement and development of the Rydalmere laboratories was referred by the Premier to the Treasurer in June, 1977.

BIOMETRICAL BRANCH

FUNCTIONS

The Biometrical Branch is responsible for the statistical and mathematical aspects of the Department's research activities. The staff of the Branch consult with research staff at all research stations, advise on proposed plans and methods of analysis, and critically examine all research projects. They also keep research staff up-to-date with advances in statistics and computing through seminars and training courses.

Consultation between biometrician and research worker often leads to co-operative research efforts in which the biometrician does the statistical part and assists in preparing the results for publication. It also produces topics for biometrical research which are carried out as time permits.

The Branch is also responsible for scientific computing and the staff prepare programmes to perform statistical analyses and advise on their use.

NEW DEVELOPMENTS

A position of biometrician was transferred from Sydney to Agricultural Research Centre, Yanco, so that biometricians are now located in all regions to provide statistical advice directly to research staff.

DIVISION OF MARKETING AND ECONOMICS

FUNCTIONS

The Division of Marketing and Economics does research on all aspects of the production, marketing and handling of agricultural products, including development of research and extension methodology in agricultural economics and farm business management; provides advice on commodity prospects, marketing schemes and rural policy generally, and working mainly through other Divisions provides extension services in agricultural economics and farm business management. The Division also provides specialized liaison and in-service training in agricultural economics and farm business management to both departmental research and extension officers.

The Division publishes a journal, the *Review of Marketing and Agricultural Economics*; a monthly *Commodity Bulletin*; and a bulletin series which under the general title of *Miscellaneous Bulletin* reports a variety of research studies, survey results and data collections. A number of regional economists publish local bulletin series to provide farmers and others with farm management and agricultural economics data.

A complete price reporting service is provided for all produce markets in the Sydney Metropolitan Area and a retail price reporting service operates for meat, fruit and vegetables, and certain other commodities. Crop forecasts and market outlook and commodity information for a number of products are distributed to the media, producers, processors and other Government authorities.

The Division also administers the Marketing of Primary Products Act, 1927, under which a number of primary produce marketing boards are constituted.

Officers of the Division are representatives on a number of State and Commonwealth boards and committees. Under the terms of the Dairy Industry Authority Act, the Division conducts cost-income surveys of all aspects of the dairy industry in New South Wales. Submissions on Rural Industry matters are prepared and presented to the Industries Assistance Commission.

STAFF

New Appointments and Resignations

Dr D. E. Maccallum (Chief of the Division) was seconded to the Treasury for a period of about six months to lead a group studying the New South Wales Economy. Dr Maccallum was also appointed as Chairman of the Dairy Industry Prices Tribunal.

Miss S. A. Hodgkinson was appointed Acting Chief during the period of Dr Maccallum's secondment.

Dr B. J. Standen and Mr F. H. Drane were appointed to the positions of Principal Economist.

Mr G. A. Forsythe was appointed as Special Economist (Marketing) and Mr K. Munro was appointed as Special Economist (Surveys).

Mr J. N. Walmsley was appointed to the position of Senior Clerk.

Mr K. H. McDonald was appointed to the position of Supervisory Markets Officer.

Overseas Visits

Mr B. K. Compton, Special Economist (Crop Forecasting) visited Japan, South Korea, Taiwan and Hong Kong as a member of a delegation from the New South Wales Barley Marketing Board.

Mr B. D. Buffier spent 14 weeks touring the U.S.A. and Canada studying farm business management, as a result of being awarded a Churchill Fellowship.

Mr D. Gilbert spent 6 weeks in Iceland on a Rotary Group Study Exchange Award.

Conferences

Officers of the Division represented the Department at the National Agricultural Outlook Conference; the Annual Conference of the Australian Economics Society; the Annual Conference of the Australian Farm Management Society; the Annual Conference of the Royal Institute of Public Administration.

Committees

More prominent committees on which Divisional officers serve are: Australian Tobacco Board; Tobacco Industry Leaf Finance Agency; Dairy Industry Prices Tribunal; State Development Co-ordinating Committee; Inter-Departmental Standing Committee on Rural Adjustment; Guidelines Committee assisting the Rural Assistance Board, Subcommittee on Economics and Marketing to the Standing Committee on Agriculture.

As well, six economists are currently Ministerial Nominees on State Marketing Boards.

Staff Training

During the year, one officer was awarded a degree of Doctor of Philosophy by the London School of Economics, and another completed the Degree of Master of Business Administration from the University of New South Wales. Currently, four officers are enrolled at universities for studies leading to the Award of a Ph.D. Two officers commenced full-time study leave overseas for three years in August. Another eight officers are pursuing degrees, diplomas and certificates on a part-time basis in Law, Economics, Agricultural Science, Arts, Education and Commerce.

Overseas Visitors

Overseas visitors to the Division included an economist from the U.S.D.A.; a horticulturist from New Zealand; two officers from New Zealand; an officer from the Department of Agriculture, Alberta; the Head of the Agricultural Trade and Markets Division of O.E.C.D. in Paris; the Deputy Minister of Commerce in Iran and one of his Assistants; a member of the Japanese Food Agency.

New Developments

A review of the Marketing of Primary Products Act, 1927, continued and a draft is in preparation for consideration by the Minister for Primary Industry.

The format of the ABC "Country Hour" programme was changed to a more consumer-oriented agriculture style. This necessitated a change in the Division's style of participation.

A working party to examine the food marketing system in New South Wales was established. The aim of the working party is to effect cost efficiencies and review the overall effectiveness of the food marketing system.

In April a 2-day workshop was held to discuss the Marketing of Primary Products Act prior to revision of the Act. The workshop was attended by members and officers of agricultural produce boards, representatives of the grain industry, grain merchants associations, and Departmental officers.

A new system of livestock market prices reporting was introduced in June. The aim of the new system is to provide a more accurate and more comprehensive coverage of the sales of livestock, initially from Homebush but ultimately throughout New South Wales. The service has been developed in conjunction with the Victorian Department of Agriculture to give a comprehensive account of marketing conditions in the two main livestock states.

As a first stage in the extension of the service to country selling centres approval has been given for the creation of a position of Market Reporting Officer at Wagga.

DIVISION OF RESEARCH SERVICES

FUNCTIONS

The Division of Research Services is concerned with the Department's research administration, research station management, architecture and agricultural engineering. *Research administration and research*

Industry research grants are administered by the Division, research by all Divisions and in all regions is co-ordinated and liaison is maintained with other research groups.

Research station management

Management of research and the associated staff and facilities on nineteen research establishments is co-ordinated.

Architecture

The Architect Section comprises three architects and support staff is responsible for the organization of the Department's Capital Works Programme. It also designs, supervises and advises on the Departmental building and maintenance programmes and service installations, provides liaison with officers of the Department of Public Works and the Housing Commission and provides plans and building advice to other authorities and farmers.

Agricultural Engineering

The Agricultural Engineering Section is responsible for:

- Regionalized farm mechanization extension by nine agricultural machinery officers to advise farmers on the characteristics, use and maintenance of power units and agricultural machinery and on the development of farm mechanization systems.
- Engineering research by seven engineers and their support staff at the Agricultural Engineering Centre, Glenfield, to develop prototype farm machinery and farm mechanization systems; and to design and construct equipment and machinery for specific Departmental research projects.
- Plant inspection by four plant inspectors who also advise and assist Departmental officers with respect to the purchase of scientific instruments, farm machinery and motor vehicles.

STAFF

Severances and Appointments

Mr G. A. Crawford, Deputy Chief of the Division of Research Services, retired in December, 1976, after 40 years' service in the Department of Agriculture. During his career in the Department, Mr Crawford occupied a wide range of positions in the Division of Plant Industry and administrative areas. Following his initial training, he was appointed District Agronomist at Berrigan and Deniliquin and then Manager, Agricultural Research Station, Leeton. He was then appointed as Regional Supervisor for Agriculture, Leeton, and served in this position for a number of years. He was then transferred to the Division of Plant Industry where he held a number of senior positions. In 1945, he was appointed Chairman of the District Wheat Agricultural Committee at Leeton and in 1967, he was seconded to the Commonwealth Government to assist with a Colombo Plan Project to establish a sheep stud at Hissa in India. Mr Crawford was appointed Deputy Chief, Division of Research Services, in 1970.

Mr C. R. Hood, Principal Officer (Management), was appointed to the position of Deputy Chief in January, 1977, following the retirement of Mr G. A. Crawford.

Mr P. J. Holligan, who was Officer-in-Charge, Agricultural Engineering Centre, Glenfield, since its establishment in December, 1972, was appointed Senior Agricultural Engineer in October, 1976, vice Mr J. G. Drever, who retired in December, 1975.

Mr P. A. Witschi, Principal Agronomist (Irrigation) was appointed Principal Officer (Management) upon the appointment of Mr C. R. Hood to Deputy Chief, Division of Research Services.

Mr D. Leggo, Principal Horticulturist (Research), was appointed Regional Director of Research for the North Coast Regional Research Directorate in April, 1977, replacing Dr S. G. Grimmett who was appointed Chief, Division of Plant Industry.

Mr R. A. Claxton, Assistant Research Co-ordinator, was seconded to Australian Fertilizers Ltd, for four months in May, 1977. This was in exchange for one of their staff. Mr Claxton's assignment to Australian Fertilizers Ltd will be to investigate and report on the future of bulk distribution of cropping fertilizers.

Mr W. R. Archer, Assistant Principal Officer (Management), was seconded to the Department of Corrective Services in February, 1977, for six months to investigate and advise them on the future role and development of their agricultural and related industries.

Mr J. K. Bowler, Manager, Agricultural Research Station, Glen Innes, has been seconded as Lecturer in Beef Cattle at the C. B. Alexander Agricultural College, Tocal, from May, 1977, to the end of the academic year.

Overseas Visits and Conferences

Dr W. V. Single, Regional Director of Research and Mr K. J. Symes, Curator, Australian Wheat Collection, attended the Third International Congress of the Society for the Advancement of Breeding Research in Asia and Oceania.

Dr D. J. McDonald, Regional Director of Research, participated in the Association for Science Co-operation in Asia Seminar on High Yielding Varieties of Paddy Rice held in Tokyo. On his return from Japan he visited the International Rice Research Institute in the Philippines.

Mr R. N. Macindoe, Manager, Poultry Research Station, Seven Hills, presented a paper at the First Combined Stock Feed and Poultry Convention in Melbourne.

Mr R. Wingate-Hill, Officer-in-Charge, Agricultural Engineering Centre, Glenfield, attended the Commission I Meeting of the International Society of Soil Science in Adelaide.

Mr P. J. Garland, Agricultural Mechanization Officer, Tamworth, visited North America and Canada to study cultivation equipment, minimum tillage and its current application to this country.

Committees

Some of the more significant committees on which Officers of this Division are members:

- (1) Advisory Committee on Research in Agriculture;
- (2) Wheat Industry Research Committee of N.S.W.;
- (3) Cotton Research Co-ordinating Committee, Narrabri;
- (4) National Rust Control Programme—Working Party;
- (5) Working Committee on the Energy Crisis in Agriculture;
- (6) National Committee on Agricultural Engineering Institution of Engineers Australia;
- (1) Horticultural Engineering Commission of the International Society for Horticultural Science;
- (8) Organizing Committee for the Society for the Advancement of Breeding Researches in Asia and Oceania (S.A.B.R.A.O.);
- (9) University of N.S.W. Manildra Field Station Advisory Committee;
- (10) Wheat Industry Research Council of Australia.

Assistance to Overseas Personnel

The Tropical Fruit Research Station, Alstonville, provided a period of training in tropical fruit and vegetable production to Mr Monako Ke from Tonga.

The Agricultural Research Station, Glen Innes, provided a 9-month training programme to Mr Tron Einer Svenke, a Rotary Exchange Student from Norway.

Gosford Horticultural Research Station provided 2 months' training in the production of citrus and nursery techniques to Mr Krishna Swamy, Senior Assistant Director of Horticulture, Bangalore, Karnataka State, India.

The Agricultural Research Centre, Wollongbar, provided assistance to Mr R. Du Four, New Zealand, and to Dr A. S. Grewah, India, on matters relative to tropical pastures, tick control and cross breeding dairy cattle.

PRODUCTION AND LIVESTOCK

Production during the year at Research Stations administered by the Division was: Rice 67.4 tonnes, wheat 674 tonnes, oats 362 tonnes, barley 77 tonnes, maize 1.5 tonnes, sorghum 279 tonnes, sunflower 0.116 tonnes, soybean 3 tonnes, hay 1 191

tonnes, silage 210 tonnes, tobacco 237 kg, pasture seed 52 kg, cotton 16 tonnes, potatoes 23 tonnes, skins 259, wool 58 042 kg, bananas 171 tonnes, avocados 30 tonnes, tomatoes 25 tonnes, apples 403 tonnes, pears 19 tonnes, grapefruit 84 tonnes, lemons 36 tonnes, mandarins 32 tonnes, oranges 627 tonnes, peaches, 27 tonnes, apricots 7 tonnes, dried fruits 14 tonnes, cuttings 3 000 tonnes, peach buds 4 000 tonnes, citrus buds 389 320, citrus seed 48 kg, stone fruit seed 15 kg, strawberry plants 57 550, fruit trees 1 294, eggs 98 900 doz, poultry meat 19 000 birds.

Livestock numbers as at 30th June, 1977: cattle 3 420, sheep 19 363, goats 840, pigs 424, horses 17, poultry 7 052, pheasants 478.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

FUNCTIONS

The Royal Botanic Gardens and the National Herbarium of New South Wales provide broad coverage of advisory information and research services in botany and ornamental horticulture. The Herbarium contains some 750 000 specimens, representing in particular the native and naturalized flora of Australia but also including a collection of world flora.

Its research activities include the production of a detailed and comprehensive Flora of New South Wales but studies are extended where appropriate to wider problems in systematic botany, including investigations of breeding systems and chromosomal studies. In the ecological field, a vegetation survey of New South Wales is the major activity.

The Gardens display a wide variety of plants from throughout the world and are undergoing gradual redevelopment to fulfil an enlarged educational function in general botany and biology as well as in the horticultural and landscaping spheres. Associated with the Gardens are the Mt Tomah Annexe for cool-temperate plants, as well as the Domains and Centennial Park, the functions of which are those of large parks, catering for passive recreation, sporting activities, and wildlife conservation.

STAFF

Vacancies

As in previous years staff turnover remains a problem in the horticultural activities of the Royal Botanic Gardens and allied areas and difficulties continue to be experienced in maintaining full staff strength.

Severances and Appointments

The Public Service Board approved the creation of the new positions Assistant Director (National Herbarium) and Assistant Director (Royal Botanic Gardens). These replaced the previous positions of Deputy Chief Botanist and Superintendent and were filled in July, 1976, by Dr B. G. Briggs and Mr W. R. Watson, the former occupants of the deleted positions. The position of Assistant Superintendent was re-titled as Superintendent and Mr C. Weale took up duty in the position of Superintendent on 19th July, 1976, transferring from the Division of Horticulture.

Mrs B. J. Jacobs resigned from the position of Education Officer and in January, 1977, Mrs D. Alford took up duty in this position. Mrs Jacobs had held the position of Education Officer since the inception of the Education Programme of the Botanic Gardens, starting with the feasibility study which initiated this development. Her excellent and imaginative work has led to a wide-ranging programme becoming established within a relatively few years.

With the cessation of funding by the Australian Biological Resources Study the four research assistants employed on grant funds have ceased duty. Loss of these positions will substantially slow down several research projects.

Overseas visits and conferences

Dr J. M. Powell (Botanist) attended the IV International Palynological Conference held at the Birbal Sahni Institute of Palaeobotany in Lucknow, India, from 29th December, 1976, to 5th January, 1977, and presented two papers.

The Assistant Director (National Herbarium) represented the National Herbarium of New South Wales at the meeting of the Committee of Heads of Australian Herbaria at Perth, 30th September, 1976, to 1st October, 1976.

The Assistant Director (Gardens) and the Superintendent, Centennial Park, represented this institution at the Golden Jubilee Conference of the Australian Institute of Parks and Recreation in Melbourne, 3rd–8th October, 1976. The Assistant Director (Gardens) also attended the Seminar "Defining and Protecting Green Spaces" conducted by the Australian Institute of Urban Studies.

Mr J. Armstrong (Botanist) attended, as guest speaker, the "Fourth Annual Native Plant Study Weekend" at Ringwood, Victoria. The Maroondah Group of the Victorian Society for Growing Australian Plants organized the programme.

Mr D. F. Blaxell, Senior Botanist, attended a 5-day conference "Growing Australian Native Plants" held at Lake Burrendong Sport and Recreation Centre, 23rd–27th August, organized by the University of New England. He also attended the inaugural meeting of the Australian Orchid Foundation Research Committee.

Committees

The Director continues to serve on the organizing committee for the XX International Horticultural Congress, Flora of Australia Committee of the Australian Academy of Science, the council of the Linnean Society of New South Wales (a Vice-President 1976) and the editorial committee of the international botanical journal *Adansonia*, published in Paris.

The Director has been appointed to the organizing committee for the XIII International Botanical Congress. The Congress will be held in Sydney in 1981 and planning of the programme and arrangements is under way. Dr B. G. Briggs, Assistant Director (National Herbarium), has been invited to serve as Chairlady of the committee for the section Systematic and Evolutionary Botany; Dr S. W. L. Jacobs has been invited to serve on the Sydney Committee; Mr D. F. Blaxell on the Excursions Committee and Dr J. M. Powell on the committee for the Historical Botany section of the Congress.

Dr Briggs represents the National Herbarium on the Committee of Heads of Australian Herbaria and of the council of the Linnean Society of New South Wales, holding office as President for 1976. Mr J. Pickard was also a member of the council of the Linnean Society for several months and is a member of the council of the Ecological Society of Australia. Mr Blaxell is a member of the International Orchid Commission and of the board of directors and research committee of the Australian Orchid Foundation.

The Assistant Director (Royal Botanic Gardens) has been appointed to the Inter-Departmental Committee to re-examine the feasibility of locating a helicopter landing site in the central business district of Sydney.

He has also been appointed to the Inter-Departmental Committee to assist the Cabinet Subcommittee formed to study the co-ordination of future planning in the Moore Park, Centennial Park area. He continues to serve as chairman of the Committee for the Programme on Ornamental and Amenity Horticulture for the XX International Horticultural Congress and as chairman of the Horticultural Committee of the Royal Agricultural Society. He also continues to serve on the horticultural advisory committees of the Hawkesbury Agricultural College and Department of Technical and Further Education, the Federal Council of the Royal Agricultural Institute of Parks and Recreation and the Historic Gardens of Australia publication committee of the National Trust of Australia.

The Senior Landscape Designer continues as chairman of the New South Wales group of the Australian Institute of Landscape Architects.

Overseas trainees

Notable visitors from overseas and interstate continue to be assisted in their investigations by consultation with botanical and horticultural staff and/or by granting of study facilities.

The tenth, eleventh, twelfth and thirteenth Hong Kong Fellows to be placed at the Royal Botanic Gardens for intensive horticultural training completed the 2-year period and returned to their posts with the Parks and Recreation Division of the Urban Services Department, Hong Kong Government.

Miscellaneous administrative matters

Detailed sketch plans of the proposed new Herbarium building have been developed by the Government Architects Branch, Department of Public Works. This has involved much discussion with Herbarium officers.

Approval was granted for the introduction of flexible working hours for professional, clerical and senior horticultural administrative staff. Because of the constraints of work objectives it has not been introduced for outdoor staff.

Livestock

Four Departmentally bred Arab horses (three geldings and one mare) remain in service as ranger's mounts at Centennial Park.

AGRICULTURE EDUCATION SECRETARIAT

FUNCTIONS

The Secretariat was established in 1970 to provide information and vocational education for future farmers, property managers and secretaries, and for those planning a career in related service industries.

A prime function of the Secretariat is to provide information, both oral and written, to parents and prospective students in regard to the various courses, and enrolment procedures, at the colleges.

The section maintains records of Commonwealth and State funds expended on capital works projects at the three agricultural colleges, and undertakes liaison on their behalf with the Department of Public Works in relation to construction matters, and with the Higher Education Board in respect of the administration of capital and recurrent funds.

STAFF

Severances and Appointments

Vacancies

The position of House Supervisor at C. B. Alexander Agricultural College has been vacant for nearly 22 months. The delay in filling the position was due to a salary anomaly which has now been overcome.

Some difficulty is being experienced in finding a suitable applicant for the position of Lecturer, Secretarial Studies, at Orange Agricultural College.

Severances and Appointments

Appointments to the more senior positions at the agricultural colleges were:

Mr R. H. B. Tonkin, Principal Lecturer, Orange Agricultural College;

Mr B. D. Swann, Senior Lecturer (Academic), Yanco Agricultural College;

Mr H. O'Donnell, Lecturer (Pastoral Zone Management), Yanco Agricultural College;

Mr N. R. Jones, Lecturer (Plant Production), Orange Agricultural College. Mr Jones was previously Senior Lecturer (Academic) at Yanco Agricultural College;

Mrs U. E. Wettenhall, Lecturer (Farm Production), Orange Agricultural College;

Mr M. A. Lukins, Lecturer (Farm Management), Orange Agricultural College.

The only noteworthy severance was the resignation of Mr T. J. Croft, Senior Lecturer (Business Management), Orange Agricultural College.

Conferences

Mr W. W. Long, Senior Lecturer (Agricultural Economics), C. B. Alexander Agricultural College, attended the Tenth International Course on Vocational Education and Teaching in Agriculture at Zollikofen, Switzerland, during the period 10th to 27th August, 1976.

Training

The Acting Secretary, Orange Agricultural College, attended a 5-day middle management course at Ryde during May, 1977.

Six members of the staff at C. B. Alexander Agricultural College continued with post-graduate studies in education at the University of Newcastle. Another lecturer commenced the residential Graduate Diploma in Extension Course at Hawkesbury Agricultural College.

Two Yanco Agricultural College lecturers are undertaking courses at the University of New England, and another is undertaking a course at the Riverina College of Advanced Education.

Committees

Staff of the Agricultural Education Secretariat and the Agricultural Colleges are members of the following committees, etc.:

Mr J. E. Jessup, Executive Officer, Agricultural Education, Member, Institute of Rural Studies. Secretary/Member, C. B. Alexander Foundation Member, Public Service Board Examinations Committee.

Mr R. J. Napier, Principal, Orange Agricultural College, Member, Central Western Regional Advisory Council (Education and Welfare Committee) Member, Orana Rural Training Committee.

Mr J. Davis, Senior Lecturer, Orange Agricultural College, Member, Institute of Rural Studies.

Mr G. C. McFarlane, Principal, C. B. Alexander Agricultural College, Chairman, Course Advisory Committee. Member, Board of Studies.

Mr B. W. Urquhart, Deputy Principal, C. B. Alexander Agricultural College, Member, Institute of Rural Studies.

Mr K. W. Bannister, Principal, Yanco Agricultural College, Chairman, Course Advisory Committee. Member, Board of Studies.

Assistance to Overseas Personnel

The C. B. Alexander Agricultural College provided assistance to eighty-two people from overseas countries. This assistance was mainly in the form of short courses, short-term attachment for experience, and day visits.

Yanco Agricultural College provided courses for Colombo Plan students and personnel sponsored by F.A.O.

NEW DEVELOPMENTS

Orange Agricultural College offered a new course titled "Associate Diploma in Farm Secretarial Studies" in February, 1977. The aim of this course is to provide students with a thorough training in the techniques and business recording aspects of farm production, which will enable them to become proficient farm secretaries. The initial enrolment for the course was thirty-one.

C. B. Alexander Agricultural College accepted twelve Australian Milking Zebu heifers from CSIRO to contribute to the Department's project to build up information on the AMZ breed.

The appointment at Yanco Agricultural College of two Senior Lecturers, who alternate as Principal's Deputy, has resulted in greater delegation of responsibilities within the College's administration.

A new course titled "Advanced Certificate Course in Pastoral Zone Management" commenced at Yanco Agricultural College in February, 1977. The course is designed for persons who will be involved in property management in western pastoral regions. It provides vocational training in management and environmental problems, and the specialized industry techniques applicable to the region.

The advanced courses at Yanco were reconstructed to allow wider option of subjects. The response by students in the initial year of the reconstructed course was good and resulted in the number of students enrolled in second year being the highest ever.

Information on Livestock Numbers at Colleges

Type of Stock	O.A.C.	C.B.A.A.C.	Y.A.C.	Total
Sheep	1,163	108	1 038	2 309
Beef Cattle	352	1 370	175	1 897
Dairy Cattle	..	270	152	422
Horses	21	44	6	71
Goats	..	5	..	5
Pigs	..	..	102	102

3. RESEARCH ACTIVITIES

HORTICULTURE AND HORTICULTURAL PRODUCTS

STONE FRUITS

Variety Evaluation

Prunes: Initial indications are that three varieties: French Improved, Burton and Coates are higher yielding than the standard d'Agen variety.

Clonal Selection

Peaches: Highest productivity has been obtained with the early Queen selections of Johnson and Yanco Queen. Yanco Queen has produced the greatest commercial yield. Of the late strains, Sainty Queen was again more productive than Taylor Queen. No differences in the performance of standard Golden Queen clones were apparent.

d'Agen Prunes: The Tevo selection is continuing to be a higher yielding strain.

Repository: A repository of virus tested clones of plums, prunes, cherries and citrus is being operated by the Department. Virus tested trees in this repository will provide the basis of budwood multiplication for distribution to nurserymen.

Rootstocks

Peaches: As in previous years, yields obtained from Golden Queen, Yanco Queen and Gaume varieties on Pullar, Golden Queen and Elberta rootstocks have been higher than when grown on Nemogard and Okinawa rootstocks.

Prunes: Of the recently introduced plum rootstocks, Buck Plum is proving most successful. Buck with Myrobalan 67/1 or Damas C as intermediate stempieces are the best performing combinations.

Apricots: Both the apricot varieties Trevatt and Morocco, grown on Buck plum rootstock, have consistently yielded better than trees on Apricot seedling and show no adverse effect on quality.

Peach Pruning and Training

High productivity peach plantings: Several Dessert Peach/Variety/Training demonstration blocks have been established on the Central Coast and in the Hills District with the aim of increasing early production by using greater numbers of trees in hedgerow plantings trained to the palmette system. Similar demonstration blocks for canning peaches in the Murrumbidgee Irrigation Area (M.I.A.) have not produced significantly greater yields than conventional plantings, although a 30 per cent increase in labour productivity in the conduct of general management operations has been achieved.

High density plantings: A new intensive canning peach planting has been established at Yanco Agricultural Research Centre to investigate alternative methods of peach growing in the M.I.A. This will involve research and development into increased production efficiency by utilizing fully mechanized management and higher density planting systems.

Mechanical Thinning

Peaches: Significant increases in fruit size of canning peaches has been obtained by using tree shakers for mechanical thinning. This enables increased returns to the grower.

Prunes: The use of tree shakers for mechanical thinning of prunes in dryland production areas is not profitable, even though a definite increase in general fruit quality is evident. Thinned trees give lower fresh and dry yields, leading to lower economic returns.

Mechanical Harvesting

Mechanical harvesting of sweet cherries for fresh market consumption is a feasible alternative to hand harvesting for the varieties Ron's seedling and Napoleon only.

Cherries: To achieve satisfactory fruit removal of good quality fruit by the shake/catch method of harvesting, the growth regulators Alar 1 000 p.p.m. and Ethrel 150 p.p.m. are necessary as chemical aids to mechanical harvesting.

Hand harvested Napoleon cherries for processing achieve 42 per cent more first grade fruit than is obtained with machine harvesting, although there is no significant difference between the two harvest methods for off-grade fruit.

Processed stone-fruits—M.I.A.: Mechanical harvesting of apricots, prunes, plums and peaches has proven to be commercially acceptable to both growers and processors. At the conclusion of the Adrian Harvester Evaluation programme in 1977, the usefulness and efficiency of machine harvesting has been fully demonstrated.

Post Harvest Storage

Cherries: Analysis of membrane lipids present in freshly-harvested sweet cherries has been performed to determine the chilling sensitivity of the cherry under cold storage conditions. Ethylene dibromide fumigation of cool stored cherries as a quarantine treatment against Queensland fruit fly (*Dacus tryoni*) proved to be phytotoxic at the rates required for adequate control against fruit fly.

Peaches: Continuous cool storage of dessert peaches in a controlled atmosphere of 20 per cent carbon dioxide reduces the incidence and severity of low temperature breakdown, but selection of fruit at the correct stage of maturity is essential for success.

Biological Studies

Bud failure of stone fruits: Bud-shedding can be dramatically reversed by tree injections of hydroxy and methoxy derivatives of cinnamic acid to prevent bud failure on canning peaches in the M.I.A.

Fungal disease identification: The occurrence and geographic distribution of a variety of important diseases, as well as the identification of new diseases, are being monitored and control measures determined. A new type of brown rot (*Sclerotinia laxa*) has been identified, with a reported range from the Central Tablelands to the South West Slopes.

Fungicide resistance: Resistance of brown rot (*Sclerotinia fruticola*) and blue mould (*Penicillium expansum*) to the benzimidazole group of fungicides, and cross resistance of these fungi to carbendazim and thiophanate methyl fungicides, has been demonstrated in the Central Tablelands. Two new fungicides, Glycophene and 2 aminobutane, provide good control of the resistant strains of *S. fruticola* and *P. expansum* respectively.

Deciduous fruit tree viruses: A comprehensive index of reports on the occurrence, properties and diagnosis of virus diseases is being prepared along with the compilation of published information on apple virus diseases recorded over the past 15 years.

Bacterial canker of cherries: Effective control of the causal organism *Pseudomonas syringae* has been achieved using an extensive spray programme of streptomycin sulphate and bordeaux mixture on nursery trees prior to their distribution to orchards. Commercial application of this treatment is dependent on the registration in New South Wales of antibiotics for application to cherry trees.

POME FRUITS

Rootstocks and Varieties

Apple rootstocks: At the Bathurst Agricultural Research Station, 13 rootstocks have been tested for Granny Smith, Delicious and Red Jonathan. After 14 years and 7 good commercial crops, Red Jonathan has carried the heaviest crops on Merton 793. Delicious and Granny Smith have carried their heaviest crops on MM106, particularly in the early years. The cropping of NS6 has been similar to MM106, except in the first year or two.

Hardwood cuttings of apple rootstocks: Cuttings from virus-free material rooted better than virus-infected material in heated propagation beds at Bathurst A.R.S. They also had a mass of roots from around the base of the cutting rather than only one or two. In spite of this improvement, Northern Spy is still difficult to root.

Quince varieties: A collection of 15 quince varieties is being evaluated at the Bathurst A.R.S. Production for most varieties ranged from 50 to 70 kg per tree. In cool storage, Portugal, Orange, and to a lesser extent Fuller and De Bourgeat, maintained fair to good quality after 9 weeks.

Apple varieties: Of the new varieties and selections being tested at Bathurst, Harold Red Delicious, a striped bright red Delicious type, is showing early promise. Other more recent varieties include two spur-type Delicious, Glen Vimy and a local selection, as well as Fuji which matures later than Delicious but does not colour as well.

Tree Training, Spacing and Size Control

Pear tree training: Different methods of training and trellising Williams (WBC) pears are being tested at Yanco Agricultural Research Centre. Already, after 4 years, palmette and pyramid trained trees are coming into earlier and heavier production than conventional vase trees.

Within-row spacing of apple trees: A 10-year-old planting at the Orange Agricultural Research Centre is comparing 3 apple varieties on 4 rootstocks using 13 different within-row spacings. There has been a reduction in growth and cropping of trees in the two closest plantings (about 2 m) for all varieties on the more vigorous rootstocks MM106 and NS6. As yet there has been no such effect by the more dwarfing rootstocks.

Mechanical hedging: Preliminary studies at Bathurst on mechanical hedging of Granny Smith, Delicious and Bonza apple trees showed that hedging had little detrimental effect on fruit number and size. Fruit colour was reduced slightly in Delicious. Regrowth was controlled with dimazide and summer pruning. Excessive summer pruning did increase sunscald.

Nutrition

Apple liming response: Liming response is being assessed on two orchard sites at Batlow, one on replant apple land and the other on new apple land. There has been little response in pH on the new apple ground. However, pH has been raised by more than 1 pH unit on the replant soil, where a serious magnesium deficiency is also developing.

Apple nutrient status: Investigations have been initiated to assess nutrient status of apple trees in three districts, and to review leaf analysis surveys. The mean levels of nitrogen, phosphorus, potassium, calcium and magnesium were all satisfactory or better. Copper, boron and manganese were satisfactory at Orange and Batlow but not at Armidale. Zinc was low for all three districts, indicating that either the majority of orchards were zinc deficient or the standards need adjustment. It was concluded that many orchards were using more fertilizer than they needed, particularly potassium and phosphorus.

Crop Control

Chemical thinning of apples: Ethephon, carbaryl, NAA and NAD all thinned Delicious apples, reducing fruit set by 10–50 per cent. NAA at 3.75 p.p.m. plus carbaryl or NAA at 7.5 p.p.m. were the most effective. NAD and ethephon did not thin sufficiently, and a slight size reduction occurred with both. Carbaryl caused slight russetting, and NAD left a significant number of small chat fruit.

The same treatments also thinned Jonathans to 20–35 per cent of unthinned controls. All treatments increased fruit size according to fruit set reduction. Again the combination of NAA and carbaryl was most effective.

Surfactants on chemical thinning: There was negligible benefit from adding surfactants to carbaryl. There was only marginal improvement from adding surfactants to ethephon. However, Tween 20 did significantly increase the thinning by ethephon.

Mechanical thinning of apples: Shaking Delicious trees earlier than 6 weeks after full bloom only removed fruit that would fall naturally. Shaking between 6 and 10 weeks gave best removal of fruitlets from the end of laterals while the laterals were still upright. Mature, rigid and hard pruned trees gave the most uniform results throughout the season. In general, more than one mechanical thin is advisable during the season. The shaker is non-selective on the size of fruit removed.

Disease Control

Apple replant problems: Fumigation with chloropicrin or ditrapex increased the shoot growth of apples in replant soils in pot trials. This was not shown with seedlings in soil from interplant sites or in soil from headlands.

Powdery mildew control: Two new fungicides, PP588 and EL222, gave control at least comparable to that by the standard benomyl treatment. A third chemical, Plondrell, was not as effective as the other two fungicides.

Apple scab control: Single application technique (SAT) involves a 6 times normal concentration spray of captafol at 3 mm green tip with no further sprays until the third or fourth cover spray. The technique was successful in controlling apple scab infections up to and including the third cover spray but no further. Regular light rain during this period helped redistribute the chemical onto new foliage.

Pest Control

Two-spotted mite control: After 4 seasons, the predatory mite *Typhlodromus occidentalis* continues to suppress two-spotted mite at Yanco A.R.C. Where release of the predator was too late in the season, propargite can be used to control excessive two-spotted mite. Similar control was obtained at Bathurst and Batlow orchards, although in both districts at least one application of propargite (0.03 per cent) was needed to reduce the two-spotted mites. Propargite does not harm the predators.

A new insecticide, amitraz (plus hydrated lime) was tested at Bathurst A.R.S. for control of codling moth without affecting natural predators. It has a similar action to chlordimeform, and it was unable to control the high codling moth populations which occur at Bathurst. At Orange and Batlow, where codling moth is not such a problem, amitraz may be satisfactory.

Diflubenzuron (PH6040), a new insecticide for codling moth control, was tested at Bathurst for its effects on populations of two-spotted mite and its predators. Although native predatory mites can survive and increase under a diflubenzuron programme, the rate of increase is slow. Also captan, which was previously thought to be harmless to predatory mites, will inhibit their development. The apparent toxicity of diflubenzuron to *Stethorus* eggs was confirmed. Diflubenzuron is not as effective as azinphos-methyl for codling moth control under Bathurst conditions.

European red mite: Studies at Batlow established that the overwintering eggs hatched late in October, much later than expected. This determines the time of oil application which may be more effective if used at early pink instead of dormant or green tip. Only cyhexatin is recommended for control of mites during summer.

Apple root weevil: Initial information on the life-cycle and bionomics of *Perperus* sp. have been established at Bathurst and Orange. This will determine control strategies. DDT was most effective for chemical control because of its long residual activity. Azinphos-methyl and methidathion when used for codling moth will also control *Perperus* sp. However, initial emergences of weevils is before normal orchard insecticide sprays.

Queensland fruit fly: The Gosford Horticultural Postharvest Laboratory is investigating cold storage to disinfect apples of *Dacus tryoni*. Initial trials showed mortalities of 99.9991 per cent for 14 days at 0.5° C and 16 days at 1.5° C. Subsequent increases in cold storage times to 16 and 18 days respectively resulted in 100 per cent mortality.

Fruit Storage

Breakdown of apples: Studies are continuing on the basic biochemical and physiological basis for breakdown of apples. Abscissic acid (ABA) appears to increase breakdown incidence. Gibberellic acid decreased and geraniol increased the amount ABA, which could explain the ability of these compounds to respectively decrease and increase the incidence of breakdown.

Calcium in apples: A considerable increase in uptake of calcium can be achieved by submerging the fruit in a calcium chloride solution and applying a partial vacuum over the solution. The uptake is very variable and excessive, however, in open calyx varieties. The excess causes injury and promotes rotting of the core.

Calcium concentrations in apples were found to be correlated with bitter pit susceptibility, a low calcium concentration being synonymous with high pit susceptibility. This could be used to predict storage life.

Post-harvest rot control: Several isolates of *Penicillium expansum* from Orange proved to be resistant to the benzimidazole fungicides currently recommended for blue mould control. Imazalil, RH2161 and 2ab were more effective than benomyl against the resistant strain on WBC pears. Glycophene, imazalil and 2ab were more effective against the resistant strain on Granny Smith apples.

Costs of Production

High density apple plantings: Detailed economic data from the density trial planting at Orange A.R.C. showed that the higher planting densities are more efficient by all measurements, and that they far outweigh the traditional methods of fruit production. Yearly costs showed that orchard related costs far outweighed tree related costs of pruning and training. Of four training systems examined, central leader, palmette, Hawkes Bay and vase, the central leader was the best by most measurements producing a cumulative 1.32 tonnes of fruit per \$100 invested at a cumulative cost of \$76 per tonne.

District studies: Costs of production and marketing efficiency are being examined in both Orange and Batlow. Preliminary cost figures show that the cost of production and sale of packed fancy grade apples for the 1976 season varied from \$4.96 to \$6.18 for immediate sale and controlled atmosphere storage respectively.

CITRUS FRUITS

Rootstocks and Varieties

Lemons: In the 1971 planting at the Gosford Horticultural Research Station (Somersby) to test scion-rootstock combinations for replant situations, all combinations except Lambert, Villa Franca and Monroe on Smooth Seville are settling into a satisfactory cropping pattern.

At the Horticultural Research Station, Dareton, *Citrus macrophylla* showed early promise as a rootstock for Eureka lemons, but tree vigour continues to decline.

Navel oranges: Lanes Late navel on six rootstocks at Somersby has proved to be an unsuitable selection for coastal conditions. After 3 years' cropping at Dareton the cumulative yields for the three most productive are 120.7 kg (Corrizzo citrange), 116.1 kg (rough lemon) and 111.8 kg (sweet orange).

Valencia oranges: A comparison of six rootstocks for Valencia oranges at Somersby continues to show that the cumulative yield per tree is greatest on Troyer citrange, but fruit is largest on trifoliata.

Mid-season oranges: No yield data are yet available in the Somersby trial to assess the mid-season varieties Seedless Valencia, White Siletta, Pineapple, Hamlin, Jaffa, Medium Sweet and Parramatta.

Grapefruit: After 7 years' cropping in the trial at Dareton to compare Marsh and Davis varieties on five rootstocks, the combination Davis/Troyer citrange has the highest cumulative yield. For production efficiency, trees on *Poncirus trifoliata* are outstanding.

Rootstock breeding: In the Somersby trial to develop new *Phytophthora* resistant rootstocks, 141 of the original 300 *P. trifoliata* hybrids have commenced the screening process. Eighty-three have been discarded, mostly because of non-uniform seedlings.

Acceptable salt-tolerant rootstocks: Results of glass house trials at Dareton and Merbein have so far shown little difference between five rootstock varieties in response to salinity stress.

Rootstock effect on water usage: Preliminary results suggest trifoliata trees exhibit higher moisture stress than sweet orange trees.

Planting Density, Tree Size Control and Crop Regulation

Dwarfing inoculations: The Somersby trial, using dwarfing inoculations into Eureka and Lisbon lemons on five rootstocks, shows little difference between the scions, and no effect from inoculating with dwarfing lines; trees on rough lemon, the two citranges and trifoliata are generally satisfactory. Trees on Seville are paler, more spindly and are developing scion overgrowth.

Double planting and hedging: at Dareton after 16 years, double planted Valencia oranges on sweet orange rootstocks, and double planted trees with interplants on *P. trifoliata*, have produced 151.2 and 133.2 t/ha more fruit respectively, than single planted trees, with considerable savings in fertilizer and water.

Where interplants were removed 8 years after planting, yields have been similar to those from single planted plots since thinning. Prior to thinning double plantings produced 51.8 t/ha more fruit than single planted plots.

Light to moderate hedging of double plantings in 1969 and 1973 controlled tree size without loss of production, but severe hedging significantly reduced yield.

Transmission of stunting: Bellamy navels at Somersby budded on trifoliata have been markedly reduced in size by inoculating with buds from dwarfed trees. Yield per tree has been significantly reduced but if the trees had been planted according to present size, with one way working space, yield per unit area would have been similar for all propagations.

Small fruit problem: Valencia oranges inoculated with severe stem-pit continue to produce the smallest fruit. Trees inoculated with buds from Valencias showing small fruit condition also produce smaller fruit than non-inoculated controls.

Nutrition

Lemons: In the N, K and Mg fertilizer trial at Somersby, trees are receiving less than to more than optimum fertilizer from the four treatments, as shown by leaf colour, foliage density and fruit yield. Juice quality is similar for all treatments.

Trials in progress with grapefruit at Dareton show surfactants in sodium chloride leaf surface sprays affected salt uptake in a distinctive way.

Mechanical Harvesting

Yanco trials show the Fridley limb shaker is better than the Adrian butt shaker as a mass removal system. The limb shaker with the abscission chemical Release ® 100 p.p.m. + Acti-aid ® 5 p.p.m. appears to be the best combination.

Air-blast harvesting, and lower concentrations of chemicals are to be investigated.

Disease Control

Gummy pitting of P. trifoliata: The search for seedlings which will serve as reliable indications of strains of gummy pitting has continued. Attempts at mechanical transmission are being made.

Citrus dieback: The dieback situation has altered substantially in recent years, and is becoming a major problem in some areas. Trials should continue at Dareton to study the effects of management, chemotherapeutants and rootstocks on symptom expression.

Stem-pit of grapefruit: Observations at Somersby, Gosford and Dareton are continuing. Virus strains with potential field protectant value have been purified and are being glasshouse tested. The effects of temperature, light intensity and nutrition on symptom expression in indicator seedlings are being examined.

Greasy-spot of citrus: Modification of pathogenicity testing has failed to produce definite results and further experiments are under way. Studies have commenced to look at the anatomy of leaf lesions and establish if fungi are present in fresh field material. Leaf litter beneath diseased trees has been examined for potential Ascomycete fungi which may be associated with the disease.

Sudden-death of citrus: Root inoculation treatments with *Coprinus* and/or *Phomopsis* spp. on navel and Valencia oranges on trifoliata rootstock at Somersby, show no obvious effects.

Citrus Pests

Red scale: In the first year of the monthly sampling programme in the Barham, Yanco/Leeton and Griffith areas, the hymenopteron parasite *Comperiella bifasciata* was most prevalent in adult females of red scale *Aonidiella aurantii*. *Aphytis melinus* and *A. chryomphali* were dominant in second instar females.

Citrus red mite: The two orchard studies in the Somersby area on the relationship between citrus red mite, citrus rust and predatory mite populations revealed there are three species of predatory mites, which varied in incidence with season and between orchards. More than twelve species of predatory coccinellid beetles have been observed with two being more important than the rest.

Citrus leaf-miner: Aldicarb at 0.22 g a.i./0.1 m³ gave effective control for about 2 months but at 0.11 g a.i./0.1 m³ was only completely effective for a short period. Carbofuran was ineffective at both rates.

Elephant weevil: Soil applications of the granular formulations of the systemic carbamates aldicarb and rydate are being tested at Rydalmere for control of elephant weevil *Orthorrhinus cylindrirostris*.

Tristezia: Cultures of black citrus aphid *Toxoptera citricidus* have been established at Rydalmere to select improved protectant mild strains of Tristezia for grapefruit and limes.

Citrus dieback: Cultures of four suspected vectors of dieback, a flatid *Siphanta ascuta*, and aphid *Toxoptera citricidus* and two cicadellids *Orosus argentatus* and *Bactrachlormorphus punctatus* have been established at Rydalmere. To date none has been shown to transmit the virus.

Postharvest Research

Ellendale tangor storage: Fungicides were evaluated in plate cultures for control of *Alternaria citri*. The most promising will be tested for *Alternaria* control in inoculated fruit held at 7.5° C.

Penicillium mould: Experimental fungicides RH 2161 and EL-222 were compared with 2 per cent SOPP and 250 mg/litre benomyl for control of benomyl sensitive and resistant strains of *Penicillium digitatum*. Low concentrations of RH 2161 gave effective control of both strains, but EL-222 was ineffective.

Sour rot: The fungicide guazatine was compared with 2 per cent SOPP for control of sour rot (*Geotrichum candidum*), in Eureka lemons and Ellendale tangors. Under several different conditions, guazatine was superior to SOPP and can provide acceptable commercial levels of control.

Packing line application of 2-AB: Tests of a 2-AB formulation under packing line conditions showed it to be stable and capable of effectively controlling all mould strains. The fungicide has been approved for industry use.

Disinfestation of lemons: Fumigation of lemons was undertaken with ethylene dibromide at a range of concentrations, to develop a disinfestation treatment against Queensland fruit fly (*Dacus tryoni*). The work is continuing.

Citrus Economics

Packing platform project: This study indicated that citrus packing aids offered no great advantage over hand/ladder picking.

Industry benefits from research: A benefit-cost study showed that substantial benefit will accrue to Australia over the next 20–25 years. Discounting these benefits by 10 per cent per year to allow for inflation, the benefits are estimated as: \$1.82 million from virus-free oranges at Dareton; \$2.39 million from close planting research at Dareton; \$0.21 million from alternate bearing work at Dareton; and \$1.68 million from hedging.

Citrus industry inquiry report: A report was submitted to the Industries Assistance Commission Inquiry into the New South Wales citrus industry.

Central Coast production costs survey: A report is being compiled, giving cost details of operating a typical citrus property in the Gosford–Wyong district.

Packing Platform Project: This study indicated that citrus packing aids offered no great advantage over hand/ladder picking.

TROPICAL FRUIT

Production

Bananas: At the Tropical Fruit Research Station, Alstonville (T.F.R.S.), analysis of the potassium/magnesium/manganese sand culture experiment was completed. This study has improved interpretations of leaf nutrient analyses and has resulted in a better understanding of banana nutrition and water use. Data obtained from the experiment are being used in the development of a computer model to stimulate banana plant growth and to develop a system for forecasting banana production in New South Wales.

In 1976 there was a yield response to all levels of trickle irrigation applied to bananas at the T.F.R.S. Application rates equivalent to 60 to 80 per cent of class A pan evaporation were superior to other rates.

Avocadoes: Limbs of trees at the T.F.R.S. were cinctured (girdled) in April, June, August, and October to determine the best time of the year for cincturing. The best time appeared to be June.

Macadamias: In the trickle irrigation experiment at Dunoon, trees produced their first commercial crop. Yields were variable and there was no clear effect of irrigation on yields.

At the Biological and Chemical Research Institute, Rydalmere (BCRI), a study of proteoid root formation is continuing.

Guavas: Ten clonal selections of guava were planted at the T.F.R.S. to assess yield potential, fruit quality, and management practices for the commercial production of dessert—and processing—guavas.

Custard apples: A small training/management trial was commenced at the T.F.R.S. Summer pruning has been shown to be practicable and a simple method for forcing selected buds has proven effective.

Litchis: The identities of four varieties in New South Wales have been clarified and data on fruit quality, yield, growth and botanical characteristics are being collected.

Pathology

Bananas: At Wollongbar Agricultural Research Centre (W.A.R.C.), a model has been developed to describe the spread of bunchy top disease following an outbreak. Investigations have shown that plantations more than a kilometre from an affected plantation escape infection. Control of the banana aphid, the bunchy top vector, within 10 m of infected plants has no effect on the spread of the disease. Recommendations have been made which will help to improve the efficiency of control measures.

The incidence of ring rot of bananas has been found to be highest when bananas are ripened at low temperatures (less than 17° C). The fungicides captan and ethazole are effective against the *Pythium* fungus thought to cause ring rot, and field trials are being initiated.

In a Brunswick River plantation, in April, 1976, nematicide applications reduced burrowing nematode numbers by 80 per cent. Since then nematode counts have been low regardless of treatment, and there has been no effect of nematicide application on the yield of fruit.

Avocados: The first crop was harvested from trees in the root rot trial at the T.F.R.S. There were differences in yields of trees under different management practices. At this stage there is no relationship between growth and yield and there has been no tree-decline due to root rot.

Mangoes: At W.A.R.C. and the T.R.F.S., mango anthracnose, a serious production-limiting disease, is being investigated. Fungicide applications have been largely ineffective in controlling anthracnose and improving yields. This may be partly due to the appearance of a benomyl-resistant strain of *Colletotrichum gloeosporioides*. Possible sources of inoculum have been identified in epidemiological studies. A number of mango cultivars have been imported with a view to finding a resistant cultivar.

Entomology

Bananas: Effective control of dieldrin-resistant banana weevil borer has been achieved with the insecticides pirimiphos-ethyl and chlorpyrifos. However, yields were not increased by chemically controlling banana weevil borer.

The incidence of corky scab was low during the year and insecticide treatments to reduce numbers of *Thrips florum* had little effect on its incidence. The population of thrips was found to be greatest in late December and late January to early February.

Other tropical fruit: Litchi pests have been investigated at the T.F.R.S. About 30 per cent of fruit was damaged by pests. *Amblypelta nitida*, a fruit spotting bug, and *Lyramorpha rosea*, the large shield bug, accounted for 80 per cent of this damage. The macadamia nut borer, *Cryptophlebia ombrodelta*, and the lycaenid butterfly, *Deudorix epijarbas*, accounted for some of the remaining damage.

Chemistry

Bananas: Investigations of the chemistry of banana ripening at the CSIRO Food Research Laboratory, North Ryde, have shown that the degree of polyunsaturation of intracellular membranes increases during ripening.

Economics

Bananas: An economic analysis of the potential benefits to the banana industry of a levelling of the supply of bananas has been initiated.

Avocados: Monetary returns to the Sunraysia area due to the estimated effect of research at the Horticultural Research Station (H.R.S.), Dareton on the rate of adoption of avocado growing have been estimated. The CSIRO contribution was considered to be about 50 per cent. On this basis, the estimated present value (10 per cent discount rate) of monetary benefits up to the year 2000 is \$1,500,000.

Macadamias: Planting densities are being investigated with a view to deriving economic criteria for determining optimum spacing.

VITICULTURE

Vine Improvement

A range of wine varieties new to the M.I.A. are being assessed for productivity and wine making quality at Griffith Viticultural Research Station. Four years' data are available for twenty-five white and thirty-one red wine varieties.

Testing of locally selected and imported candidate clones of Currant and Muscat Gordo Blanco at Dareton Horticultural Research Station continued. The selection and testing programme for wine varieties at Griffith, has been expanded to cover twelve varieties, which comprise 80 per cent of the total M.I.A. winegrape crop. After up to 4 years, large yield differences between the candidate clones are apparent in most varieties. Assessment of Shiraz and Semillon clones has also commenced in the Hunter Valley. High yielding Muscat Gordo Blanco clones at Dareton and Shiraz and Semillon clones at G.V.R.S. have been released to industry.

Virus infected local clones and overseas introductions are being heat treated at the Biological and Chemical Research Institute (BCRI) to eliminate virus. Cabernet Sauvignon, Cornichon and Semillon heat treated for 500 days have indexed free of leaf roll. Indexing has commenced at BCRI to investigate the extent of the virus legno riccio Mus at Gordo Blanco and to find a legno riccio free strain.

Irrigation (Griffith)

In irrigated Shiraz, yield increased as pruning level increased from 20, 40 to 80 nodes per vine. There was no increase from 80 to 160 nodes per vine. Pruning level had no effect on the yield of the lower yielding non-irrigated vines. Irrigation compared to no irrigation had no effect on the wine pH, but reduced wine colour intensity by 82 per cent, and anthocyanin colour by 57 per cent, and accelerated wine maturation.

Pruning, Trellising and Spacing

After the sixth crop, Shiraz vines at Griffith trained on single wire trellis in 1.5 m rows had the highest per area cumulative yield. Vines planted in rows 4.5 metres apart and trained on a 2.2 metre T trellis now have the second-highest cumulative yield.

For the first three crop years of re-trained Shiraz vines planted in 3.7 metre rows, yield increased with increasing trellis width up to 64 cm. The number of nodes per vine left after pruning, necessary to maximum yields was 75 P, where P equals pruning weight in kg. Pruning to 100 P suppressed yield. Increasing T trellis width to 120 cm increased Semillon yield by 30 per cent in the first three crop years and by 24 per cent in the second three crop years.

After three seasons of simulated two and three sided mechanical pruning hedging treatments, yield of three wine varieties was about the same as for normally pruned vines. Any yield differences were related to the number of nodes left at pruning, a factor easily controlled by varying the intensity of hedging.

Late pruning: The winemaking quality of Shiraz and Semillon grapes has been enhanced by pruning the vines after bud burst during November–December. The later the pruning the later crop development, the higher the acidity at maturity, but the smaller the bunch size and yield.

Table Grapes: The effects of seven trellis types, and crop regulation, on the yield and quality of four table grape varieties are being assessed. Quality of the first crop harvested in 1977 was best on the pergola or "Y" shaped trellises. Pruning to two rather than four cordons, bunch trimming and bunch thinning further improved quality.

Pests and Diseases

Sampling for vine mites at Griffith showed that bunch mite did not appear on leaf samples until early February. Predatory mites appeared from mid-March. A low level of mites was found on sulphur treated vines.

At Pokolbin, of the chemicals registered for grape vine scale control, only ethion in oil had any real effect.

The incidence of nematodes in M.I.A. vineyards has been studied: *Meloidgyne* spp. were present in 64 per cent, *Tylenchulus semipenetrans* in 80 per cent, and *Pratylenchus* spp. in 30 per cent of the sampled vineyards.

Mechanical Harvesting

The effect of the abscission agent ethephon in facilitating mechanical harvesting of Semillon at Griffith confirmed that responses can be expected in seasons when bunches are tight and berries less mature. The abscission effect of 500 p.p.m. ethephon, applied with dipping oil emulsion, recorded in 1976 was confirmed in 1977 for Sultana at Dareton. Application of ethephon one day before cane cutting of trellis dried Sultana reduced the proportion of capstems retained after a light "coning" treatment.

Economics

A study has shown a small negative return on capital invested in a typical non-irrigated 115 ha Hunter Valley vineyard. A yield increase of 65 per cent would be necessary to obtain a 10 per cent return to capital.

Submissions were prepared for a Senate Standing Committee Enquiry into "The Effect on the Wine Making and Grape Growing Industry of Variation in the Tax Structure". A paper on the current structure of and future development within the N.S.W. wine and winegrape industry was submitted to the N.S.W. Economy Study Group.

Grape crop forecasting depending on berry sampling thirty M.I.A. farms has been accurate for Shiraz. However, in 1977 an inaccurate prediction of ultimate berry size 4 weeks before harvest led to a major under-estimation of the final crop. A consensus estimate was more accurate.

Trellis Drying of Sultanas

The rate of application of drying oil emulsion on harvest pruned Sultanas at Dareton was reduced to 840 l per hectare, by spraying a double concentration through a "Span" sprayer, with no difference in quality.

Root Studies

Root chamber studies at Griffith have shown that simulated cultivation, and resultant root pruning, stimulated the initiation and growth of roots.

BERRY FRUITS

Research into strawberries continued at the Horticultural Research Station, Gosford. Thirty-six selections were made from the 1976 seedling block for further study. The assessment of introduced varieties expanded in the 1977 planting with eight new accessions. Plants of four varieties were produced by meristem tissue culture at New England University and were planted in the 1977 trials for comparison with standard runner plants. A small outbreak of angular leaf spot disease (*Xanthomonas fragariae*) occurred in May, 1977, but is thought to have been contained.

Work commenced at Gosford to establish a management programme for the control of two-spotted mite (*Tetranychus urticae*). Investigations were made of several new spray materials. Three species of predatory mites (*Amblyseius fallacis*, *A. womersleyi*, and *Typhlodromus occidentalis*) and one predatory beetle (*Stethorus vagans*) are being raised in the laboratory to further this investigation.

A collection of miscellaneous berries has been established for study at the Agricultural Research Station, Bathurst. The planting includes:

Trailing brambleberries: Boysenberries, youngberries, thornless youngberry, thornless evergreen blackberry, thornless loganberry, blackberry (Scoresby selection), blackberry cross (ex Glen Innes).

Erect bramble berries: Nestberries, raspberries.

Bush berries: Black currants, red currants, blueberries, elderberries, English gooseberries, cape gooseberries.

ORNAMENTALS

Potting mixes

A study on replacing expensive imported peat with wood waste is continuing. Trials indicate that composting wood wastes can overcome the problems associated with their use (nitrogen immobilization and toxicity).

For growing most plants composted and steamed hardwood sawdust can be used as a substitute for peat.

Irrigation Water Temperature

Germination and growth of a wide range of plants is affected by cold irrigation water despite the small effects that it may have on the temperature of the plant.

The effects are usually detrimental but in certain instances cold irrigation water may actually improve germination and produce a more compact plant.

Waratahs

Work at Gosford in association with the Chemistry Branch, Rydalmere, is continuing on a programme to determine the optimum fertilizer requirements of the Waratah (*Telopea speciosissima*). Experience to date indicates that cuttings from selected parent stock are necessary for establishment of uniform stands of plants, and that organic fertilizers are better for the growth of the plant than inorganic ones.

Diseases

Trials are continuing on the control of bacterial spot of carnations. Several spray programmes have been attempted without success. Fortunately however the disease was of minor importance in the dry autumn of 1977.

Drenching the soil with the experimental fungicide 3-hydroxy-5-methyl isoxazole is showing promise in controlling Fusarium wilt, a serious disease of carnations.

The use of aerated steam (below 100° C) to free seeds and other propagules such as bulbs and cormlets of pathogens is being investigated. Initial results are promising. However there is a need to develop equipment suitable for commercial use.

Several fungicides are being assessed for their ability to control *Phytophthora cinnamoni* in container plant production. Single applications of ethazol have been found effective in suppressing the disease for about 7 months. However it is only fungistatic in action. The chemical 2-chloro-6-methoxy-4-(trichloromethyl)-pyridine has also been found to be effective for about the same time but is fungicidal in action.

CROPS AND CROP PRODUCTS

VEGETABLES

Production

Cucurbits: Successful herbicide treatments were developed for water melons, sugar melons, zucchinies and cucumbers. Recommendations are likely to be adopted by the industry pending registration of one of the herbicides.

Onions: A project was commenced at Gosford Post-harvest Laboratories to determine which of the easily assessed physiological characteristics most affect bulb keeping quality.

Weed control investigations for onions grown under furrow irrigation in the M.I.A. indicate a requirement for a pre-emergent herbicide followed by a post-emergent herbicide and later a further post-emergent herbicide.

Potatoes: The continuous breeding programme at Glen Innes Research Station was expanded to obtain true seed from parents containing dominant genes for immunity to PVX and PVY. Also more imported female parents containing a high degree of resistance to common scab and PLRV were used in the main crossing programme.

The hybridization of thirty-six *Solanum tuberosum* spp. *andigena* populations with four selected pure *tuberosum* parents was completed. Progeny selections will be made in future generations.

At Yanco, several lines are showing superior yielding ability and higher cooking and agronomic qualities as compared with the commonly grown Sebago.

District trials of advanced lines were again conducted throughout the State. The seedling line S 3041 performed well as compared to the commercial cultivars Sebago and Kurrel.

Spacing and seed treatment trials with Kennebec at Orange indicate an optimum spacing of 7.3 plants per m² with no influence of seed treatment.

Seed source and disease trials at Robertson indicated little differences between seed sources and insignificant incidence of a number of common diseases.

Investigations into the mechanism and control of potato greening at Gosford have shown the usefulness of hot water dips, particularly at 65–75° C.

Nutritional needs of potato crops were investigated in the Robertson and Dorrigo districts using leaf analysis surveys, soil analysis, a field trial and glasshouse trials. Suggestions were forthcoming of magnesium deficiency and over use of fertilizers at Robertson.

Rockmelons: Work is continuing on the formulation of quality standards for marketing.

A number of varieties were tested at Yanco for keeping quality and storage temperature. Goldpok and PMR 45 were the best keepers. Melons stored at 5° C were sounder than those at 20° C after 8 days storage.

Tomatoes (fresh market): Variety trials for trellis-grown, summer/autumn crops for the Central Coast are in progress. Two lines are showing promise. Fourteen lines were tested at Mudgee for both fresh market and processing.

Tomatoes (processing): New processing cultivars were again tested at Yanco, Cowra and Trangie for paste and general purpose use. Only Selection 590 and Petomech II appeared similar to UC 134, the industry standard, but both have problems with vine storage. Further screening will be limited to no more than 6 cultivars at Trangie. At Yanco, the yield, maturity and keeping ability of UC 134, Selection 590 and Petomech were outstanding. Further testing will assess breeding material from Purdue University.

Preliminary studies on soil infiltration at Trangie have shown that cultivation and straw mulching were superior to applied gypsum in assessing lateral water movement.

Investigations of establishment methods on emergence and early growth and the effect of clump planting techniques have commenced at Trangie.

Existing and alternate pre- and early post-emergence herbicides were evaluated for control of broadleaf weeds in transplanted winter grown tomatoes in the Tweed Valley. At Yanco, the most suitable herbicide on herbicide combinations was determined for season-long weed control in direct-seeded tomatoes. Similarly, a suitable combination was developed for mechanically harvested tomatoes following trials at Mudgee, Cowra, Trangie and Richmond.

Pathology

Beans: Tests continued with green, wax and dry edible beans against summer death and rust species. These tests and the accumulated data have made available a wide range of germplasm for use by the industry and plant breeders. One uncommon rust race was found in 1976 and offers promise of a relatively simple method of incorporating resistance into pinto beans.

Crucifers: Investigations for the treatment of club root of crucifers at BCRI have shown that present recommendations are still satisfactory. The activity of coptafof against club root was also evaluated.

Mushrooms: At BCRI a number of studies on mushroom culture have been undertaken: (1) The development of suitable composts depended on the quality of both cow and poultry manures. Their effect on the C/N ratio was evaluated. (2) Weathered compost proved to be a suitable *casing* material provided the soluble salt level was below 1 000 p.p.m. (3) Further factors responsible for the initiation and development of mushroom sporophores were investigated. Future work will involve the roles of ethylene and iron in this process. (4) A control method was developed for Bacterial Blotch disease by the isolation of bacteria antagonistic to the pathogen *P. tolaasii*. Incorporation of these organisms into the *casing* of mushroom beds successfully controlled the disease. The *toxin* produced by these organisms has been found to be a phenolic glucoside of low molecular weight and stable to heat. (5) A study of the etiology of virus disease complex of mushrooms that virus-tolerant strains of mushroom spawn may be present in N.S.W. The importance of excluding virus-infected spores from new crops in farms was also demonstrated.

Potatoes: Investigations of yield decline at Yanco have shown damage due to *Rhizoctonia solani* is considerable in Spring and early Autumn crops. Further work on isolation and biology of *Rhizoctonia* in sandhills is being carried out.

A study has commenced at BCRI to identify and determine the distribution of viruses in potatoes in New South Wales.

Sweet potato: The treatments which will control the breakdown problem and determine the main rots and disorders, together with their causal organisms, are being studied at Gosford.

Further work on virus identification and its effect on yield is continuing at BCRI.

Tomatoes: A study using a granular nematicide for control of root knot in in tomato was commenced at Narara.

A number of spray programmes were evaluated at BCRI for the seedbed control of bacterial speck of tomato.

Economics

Potatoes: Following the presentation of a submission to the Industries Assistance Commission on Potatoes and Processed Potato Products, further details were investigated for the Commission. These included the relevance to the potato industry of all crop insurance, forward production contracts and a potato futures market.

A case study was commenced to establish the relative profitability of dryland and irrigated potato production in the Crookwell district.

Tomatoes: An economic assessment to identify cash flow requirements for processing tomato production in the Finley-Berrigan district was undertaken.

Entomology

Beans: Field trials at BCRI for the control of spider mite have shown some resistance of *Tetranychus* spp. to present recommendations. A number of chemicals have been found to be effective and their registration is recommended.

Crucifers: Levels of resistance in *Myzus persicae* to demeton-S-methyl and dimethoate were evaluated at BCRI.

Continuing bio-assay tests at B.C.R.I. have indicated a limited selectivity of some insecticides. Future testing will include an evaluation of individual insecticides and their combination with synergists and other insecticides. Trials aimed at efficient and economic control of crucifer pests will be continued using newer materials at varying rates.

Mushrooms: A preliminary laboratory and field evaluation of insecticides and methods of application against mushroom pests has already contributed to improving the economics of mushroom culture.

The identification and abundance of pest arthropods were examined in mushroom crops throughout the State.

Sweet corn: A study of *Heliothis* control has highlighted recommendations for control of both DDT susceptible and DDT resistant species.

Tomatoes: Trials at Yanco demonstrated the need for a detailed study of the usefulness of systemic insecticides to control vectors of Spotted Wilt Virus.

COTTON

Entomology

Pest Management: A large-scale project (involving Department of Agriculture and CSIRO entomologists) was initiated to synthesise and test research results in three new approaches to pest control: (1) Adulticide: Insecticides intended to be applied to kill adult *Heliothis* spp. moths just before it was anticipated that they would produce a peak egg-lay, based on dissection of moths caught in a light trap. (2) Management: Insecticides intended to be applied only at times when it was predicted that natural mortality would not hold *Heliothis* spp. larval numbers below threshold levels. (3) Changed agronomy: Preliminary assessment of the potential of nitrogen and water manipulation as components of a pest management system.

Blocks (10 ha) of each of these treatments were established and compared to unsprayed cotton and to a commercial block. Results indicate similar yields on the adulticide, management and commercial blocks. The commercial block had eleven applications of DDT + camphechlor, and on some of these applications monocrotophos and methyl parathion were also included. The adulticide block had six applications of a synthetic pyrethroid and three applications of monocrotophos. The management block had eight applications, four with a *Heliothis* polyhedrosis virus—a naturally occurring pathogen specific to *Heliothis* spp.

Insecticide Resistance: Changes in insecticide resistance of *Heliothis* spp. are being monitored so that alternative insecticides can be used when needed. Progeny from *H. armigera* were resistant to DDT, DDT + camphechlor, carbaryl and endosulfan. Low level tolerance was found to methyl parathion also. *H. punctigera* was susceptible to all insecticides.

Two-spotted mite (*Tetranychus urticae*) and bean spider mite (*T. ludeni*) were found to be resistant to monocrotophos and other organophosphates such as methidathion and parathion. Resistance monitoring will continue to determine if there is an increase in level of resistance. Until this occurs monocrotophos should be effective.

Insecticide Evaluation: Resistance by *H. armigera* to many chemicals, and new legislation have increased the need for alternative insecticides to the chlorinated hydrocarbons used at present. Synthetic pyrethroids have been more toxic than methyl parathion to *Heliothis* spp. Natural pyrethrins show faster knockdown of *H. punctigera* than the synthetic pyrethroids.

A 1:1 mixture of chlordimeform and *Bacillus thuringiensis* was more active against *H. armigera* larvae than either component on its own. Chlordimeform was withdrawn from the market in 1976 as it was found to be a potential carcinogen. Amitraz, which is chemically similar to chlordimeform but not carcinogenic, was evaluated as a substitute, but was found to be 15-fold less active than chlordimeform as an ovicide.

Light Trapping: Mercury vapour lamps are being used to trap cotton pests, particularly *Heliothis* spp. This information is used in radio broadcasts and in newspapers to assist cotton growers in planning insecticide programmes. Additional uses of light trap data are: to study the seasonal distribution of pests; to determine the extent of large-scale influxes of moths; and to determine if light traps can be used as a bug spotting tool. Results to date indicate that light traps, combined with moth dissection, will allow anticipation of egg-laying trends, thus providing an additional guide for decision making on *Heliothis* control. Further work should more precisely define the relative importance of parameters affecting egg-lay in cotton crops.

Agronomy

Restricting irrigation water in December delayed cotton maturity by decreasing the rate of early boll set, compared with irrigated treatments. Restricting irrigation water in March promoted defoliation, giving an early maturing crop. Irrigation in March increased yield and the incidence of verticillium wilt.

There was a marked visual interaction between water treatment and nitrogen rate: obvious differences between nitrogen treatments appeared immediately after the first watering of irrigated treatments but not until March on unirrigated treatments. However this was not reflected in yield: all water treatments had the same nitrogen yield response. Maximum yields were obtained with 100 kg N/ha. The addition of nitrogen delayed crop maturity and increased plant height, but did not affect the incidence of verticillium wilt.

Frequent irrigation and heavy nitrogen rates were particularly unfavourable to narrow row cotton. Super Orka Acala 6010 performed well in narrow rows, and is being tested further.

Pathology

Verticillium wilt: The cotton industry rates this as its most serious disease problem. In the most heavily infested areas of the Namoi Valley, losses of up to 30 per cent have been attributed to the disease.

Results to date emphasise the excellent resistance of the cultivar Namcala where high levels of *Verticillium* exist, compared to Deltapine 16. Further work is underway to develop an integrated programme of crop rotation and crop sanitation, to reduce the level of inoculum in soils to a level that will not cause yield losses.

Bacterial blight: Four different races of the causal pathogen *Xanthomonas malvacearum* have been identified in the field, 3 being highly virulent types. Prior to 1966 only one race was recorded, so this change in races accounts in part for increased severity of the disease in recent seasons. Knowledge of the races present will enable resistance to the pathogen to be incorporated into breeding lines.

Plant Breeding

Verticillium wilt: U.S. cultivars Acala 3080 and Deltapine 277, and local crosses CR21 and CR79 have shown less *Verticillium* Wilt infection than the commercial cultivar Deltapine 16.

Cultivar evaluation: The good performance of commercial cultivars Deltapine 16 and Namcala were demonstrated in trials in the Namoi and Macquarie Valleys. Coker 310, Deltapine 277 and Hancock also yielded well at some sites.

OILSEED CROPS AND GRAIN LEGUMES

Soybeans

Breeding: At Narrabri, a population derived from a Sen Nari × Dare cross was observed to be variable for degree of shattering and susceptibility to bacterial blight. High yielding types showing no shattering and low levels of blight susceptibility will be selected for row plot evaluation in 1977–78. Selection within 150 lines from 5 founder populations was attempted in order to identify superior new lines worthy of assessment as new varieties.

Varieties: At Trangie, the current commercial varieties, Bragg (2 811 kg/ha) and Lee (2 487 kg/ha), were not significantly outyielded. Dare (2 273 kg/ha) was only outyielded by the top four varieties (Bragg, Forrest, MsDare 146 and McDare 147).

At Leeton, Williams (4 588 kg/ha) significantly outyielded the current commercial varieties, highest of which was Clark 63 (4 313 kg/ha). Williams is more resistant to lodging and shorter than Clark 63. It matures 1–4 days earlier and drops its leaves more readily at maturity, thus allowing harvesting to commence 7 days earlier.

In a variety trial at Narrabri, Forrest (3 185 kg/ha) yielded significantly more than any other variety, including the local standard, Bragg. In another trial to test new introductions and promising breeding material, Bossier, McDare 132 and Forrest outyielded Bragg by 11 per cent.

Time of sowing: At Trangie, serial sowings were made at approximately 3-weekly intervals from mid-October to mid-February. The varieties tested, Wayne, Dare, Ruse, Lee and Bragg, all yielded highest from an early December sowing.

Population: At Leeton, the narrow leafed variety SRF 400 outyielded the closely related broad leafed variety Clark 63 at densities ranging from 12.5 to 100 plants/m² and row spacings from 18 to 100 cm. The yield advantage was greatest at narrow row spacings and high densities.

Insects: At Tamworth, *Nysius* spp decreased grain yield by 25 per cent and oil bug parasite (*Trissolcus basalis*) did not give adequate control of its target insect. This has now been found to be due to insufficient numbers of parasites arriving early enough to parasitize egg masses laid by the invading green vegetable bug (*Nezara viridula*). When large enough numbers did arrive the eggs had already hatched. A suitably adapted strain of the green vegetable bug parasite, if found, would obviate the need to spray and reduce the likelihood of insecticide resistance developing in tetranychid mites.

Nodulation: Research has shown which fungicides are most effective in controlling seedling diseases of soybeans and has demonstrated techniques for applying *Rhizobium* in conjunction with treated seed. Commercial application of these results to soybeans and other crops is now possible.

Sunflowers

Varieties: On the southern tablelands no variety has proven superior. Since dryland sunflowers sown during the November/December period must rely heavily on summer thunderstorms, those varieties receiving rain during critical reproductive phases will be expected to yield the highest. If sunflowers can be grown through on stored soil moisture by sowing earlier than November, earlier maturing types could then prove superior.

Population: For the southern tablelands, sowing rates of about 6 kg/ha have given consistently good yields. Slightly heavier rates can compensate for poor land preparation and the possibility of strong weed competition. The density of undersown lucerne was shown to be unaffected by the density of the sunflower crop.

At Leeton, irrigated trials have shown that maximum returns will be achieved with plant densities from 50 000 to 80 000 per ha for row cropping and 100 000 per ha where the crop is combine sown. There is no evidence that oil percentage of the seed is influenced by plant population.

Insects: At Tamworth, *Nysius* spp decreased grain yield by 25 per cent and oil yield by 1.5 per cent from early sowings. Oil quality was lowered in bug affected heads. These heads showed an increase in free fatty acid level which was shown to increase dramatically during storage at various temperatures and moisture contents.

Rapeseed

Breeding: Progress was made in developing crossbred *Brassica campestris* lines for blackleg resistance screening in 1977. These derived from crosses between Turkish lines as one parent and either Span, Torch, a low glucosinolate line (CZYY-3008) or a yellow sarson (74/291) as the second parent. Selection from this material should provide low-erucic, low glucosinolate, blackleg-resistant lines.

Varieties: In the Cowra district two trials were conducted to compare yields of seven spring varieties. In one trial Zephyr was not significantly different in yield to Target or Midas, but was better than Tower. At the other site, which was late sown, Zephyr was inferior to Target and Midas, but equal to Tower. Span (2 820 kg/ha) outyielded Zephyr (2380 kg/ha) in the May-sown trial, mainly as a result of shattering in the latter.

At Temora, from a mid-July sown trial, Span yielded 2 345 kg/ha and was marginally superior to another *campestris* variety, Torch. Of the *napus* varieties Midas yielded 1 863 kg/ha and was superior to Zephyr, Tower and Norin 16, all of which yielded approximately 1 550 kg/ha.

Winter types of both *campestris* and *napus* were shown to be unsuited to the Trangie environment. Spring types are well adapted, with yields under irrigation consistently in excess of 2 t/ha.

Time of sowing: Results from both the Cowra district and Trangie show that best yields of Zephyr were obtained from sowings in the period April to June, with a May sowing optimal. Yield of Span was less dependent on sowing time, with satisfactory results from July sowings.

Development: Studies at Tamworth demonstrated that pre-bud phenology of competent varieties was related to temperature and photoperiod to varying degrees, depending on variety. The post-bud phenology was largely related to temperature. Detrimental effects of late flowering on grain yield were found to be partly due to the influence of high temperatures in accelerating the rate of post-flowering development. At Wagga Wagga, continuous distributions from the progeny of 9 crosses indicated a complex genetic control of flowering.

Lupins

Varieties: In the Cowra district yields of the *Lupinus albus* variety Ultra were generally higher than those of the *L. angustifolius* varieties Unicrop and Uniharvest. From nine trials in the central western and southern wheatbelt Ultra was inferior in yield to both Unicrop and Uniharvest in all instances. Unicrop was superior to Uniharvest on five trials, equal in two and marginally inferior in two.

Time of sowing: For both *L. albus* and *L. angustifolius* varieties, April and May sowings in the Cowra district gave much higher yields than those for June and July.

Population: At Cowra, plots of Ultra were extensively damaged by hail, thus obscuring treatment differences. However, observations made before the hailstorm suggested that a sowing rate of 80 kg/ha (20 plants/m²) may have been sufficient for the late April sowing and 108 kg/ha (30 plants/m²) for the early June sowing.

In the central western and southern trials, sowings in April and up until the third week in May showed no yield increases above 300 000 plants/ha. In sowings made after the third week in May the optimum density was at least 400 000 plants/ha.

Nutrition: At Cowra, lupins did not show any yield response to applied superphosphate, even on soils of medium or even low phosphorus status. Despite poor yields at Wagga Wagga there was evidence of a trend towards greater yield with increasing levels of sulphur.

Weeds: A pre-emergence application of simazine (2 kg/ha) on trials at Trangie increase the yield of Unicrop by 300 per cent and Ultra by 100 per cent. These increases were effected mainly through control of Paterson's curse.

At Wagga Wagga, pre-planting, pre-emergence and pre-emergence incorporated applications of simazine (2 kg a.i./ha) and propyzamide (1 kg a.i./ha) were compared. Simazine removed all weeds and increased yields by 100 per cent no matter how applied. Propyzamide did not control capeweed, but still increased yields by 50 per cent when incorporated.

Chickpeas

Breeding: At Wagga Wagga, nine parents were intercrossed to provide an F2 population for selection in 1977. The programme aims to produce varieties for both the stockfeed and culinary market. From a large number of F5 families supplied in 1976 by ICRISAT, approximately sixty were chosen for F6 evaluation in 1977.

Varieties: In trials comparing twenty-three introductions at Wagga Wagga, Temora and Condobolin, three (CPI numbers 53007, 56566 and 61277) were consistently higher yielding. The highest protein lines, averaged over the three sites, were CPI 56329 (24.7 per cent), CPI 56296 and CPI 56315 (both 24.2 per cent), and K246 (23.9 per cent). These compare with the lowest protein line which had only 20.5 per cent. There was no evidence of any inverse relationship between seed size and protein content.

Weeds: At Trangie, simazine was the only herbicide that successfully controlled the two major weeds, barley grass and broadleaf *Sisymbrium* spp. A pre-emergence application of simazine (2 kg a.i./ha) yielded twice that of the control plots. However, higher rates of simazine, especially when incorporated, adversely affected plant stand and vigour. Broadleaf weeds were successfully controlled by terbutryne, prometryne and methabenzthiazuron.

Diseases: At Yanco, *Fusarium avenaceum*, *F. arthrosporidae* and an unidentified *Fusarium* species were shown to be involved in the root rot/wilt disease complex. Mixtures of either thiram and benomyl or thiram and captan were effective seed dressings depending on the pathogen. *Ascochyta rabiei* was isolated from seed and diseased seedlings, but pathogenicity to foliage could not be demonstrated.

Other Grain Legumes

Mungbeans (*Vigna radiata*) show good adaptation to northern New South Wales, with yields similar to maximum recorded yields anywhere in the world. Although highest yields were recorded with November plantings, the grain harvested was excessively weather damaged. December sowings appear to be more favourable. Bergen was the best variety, taking into consideration grain yield, grain size and standability.

At Grafton, twenty-one lines of Adzuki beans (*Vigna angularis*) were evaluated. Variations in yield, seed size, plant height and height of lowest pod-bearing node were observed.

WHEAT BREEDING

Wheat Improvement in Central and Southern N.S.W.

Dryland Wheat Programmes: Under a most unusual rainfall pattern in 1976 (very dry autumn and winter, long wet spring, then sharp dry finish) the named derivatives of WW15, namely Egret, Condor and Oxley, maintained their yield advantage over older wheats, though shedding in Egret was severe at times. Oxley was not as outstanding as in recent years, possibly because *Septoria tritici* was not a major factor, though severe attacks of leaf rust and *Septoria* were recorded at Wagga and Yanco trials, and a heavy stem rust infection was observed on Teal, Olympic and Egret.

Several unnamed crossbreds with Kite and WW15 in their parentage yielded particularly well and were of acceptable quality. The winter wheat WW33G and the crossbred ODHFG 11B were both rejected by the New South Wales Wheat Improvement Committee because of quality deficiencies.

Emphasis in disease control has been on the breeding for resistance to stem and leaf rust, *Septoria* and flag smut. A very severe epidemic of *Septoria* was generated by frequent irrigation in a specially sown nursery. Back-cross derivatives of the partly resistant Teal, with Eagle-type stem rust resistance incorporated, performed well in yield trials and will be seed increased this year. Other stem and leaf rust resistance genes are being "added" to Teal under the National Rust Control Programme.

Irrigated Wheat Programme: The release of Jabiru to replace the stem rust susceptible Egret provided a useful backstop for the southern irrigation areas, though it doesn't have the same yield potential as Egret. As well as yield, other characters being selected for are dwarf plant height, winter habit and resistance to *Septoria tritici* and leaf rust. Three lines WW182, WW183 and WW179 were higher yielding than Egret in the 1976 irrigated trials, all are stem rust resistant and of acceptable quality for biscuits.

Breeding material was sown late to allow selections for rust resistance and although infection was light it was adequate for preliminary screening. Likewise *Septoria* infection was late developing, though 150 hill plots were selected from 2 500.

Crosses have been made with a wide range of parents chosen for resistance to stem and leaf rust as well as *Septoria tritici*. Many of the advanced lines in the programme possess Sr 26, so efforts are being made to introduce a wider range of genes for resistance to stem rust. Use has been made of selections from the international spring wheat rust nursery.

Breeding for *Septoria* and Bunt Resistance: Techniques are being developed for the propagation and glasshouse testing of disease reactions to *Septoria tritici*. The 1976 Australian *Septoria* Nursery (AUSEN) was grown at Temora, Wagga and Roseworthy S. A. Lines were selected for further evaluation in 1977 and incorporation into the breeding programme.

With regard to breeding for bunt resistance, the aim of the work in 1976 was to examine the strain situation so that decisions could be made about which genes to use in the breeding programme. Six strains of *Tilletia foetida* and four of *Tilletia caries* have been identified, with the genes Bt 5, Bt 8 and Bt 10 being effective against these strains.

Wheat Improvement in Northern New South Wales

Breeding for Frost Resistance: Laboratory screening tests for frost resistance have been conducted on fifteen separate species of wheat, with *T. dicoccum* accessions proving the most resistant as a group. A strain of *T. spelta* has shown the best resistance so far recorded to freezing. Several of the best individual lines have been crossed with Kite, which is the most resistant of our bread wheats.

Field and laboratory trials during the year highlighted the high degree of susceptibility to frost of some of the modern dwarf wheats. These varieties are being widely used in breeders' programmes so in the future it will be necessary to ensure that their progeny are thoroughly screened for cold resistance.

In the field, plants were sprayed with a mist of paint after each of the four spring radiation frosts to identify those tillers which were elongating and those which had emerged at the time of each frost. This was followed up by tagging to mark those spikes which flowered despite the stress. This enabled selections to be made at harvest of plants which had encountered and satisfactorily survived the stresses.

Freezing-resistant lines selected are evaluated for yielding potential, bread-making quality and disease resistance. The most promising lines from the 1976 season, derived from the cross Kite/242, have proved of satisfactory quality and are undergoing further yield testing this season.

Durum Wheat Breeding: The outstanding performance of the line TAM 36A in yield trials last season confirmed its suitability as a replacement variety for Duramba. TAM 36A produced yields generally well above the site average in 17 out of 25 trials. This demonstrated its wide adaptability as conditions ranged from situations where moisture was limiting throughout (e.g., central Queensland) to sites where waterlogging was prevalent (e.g., Narrabri). TAM 36A flowers and matures seven to ten days earlier than Duramba, thus increasing its yield advantage when soil moisture is limiting near and after anthesis.

With regard to the quality of TAM 36A, it is superior to Duramba in yellow pigment content, browning reaction and mill yield, of comparable dough strength but of lower protein percentage. It also has a much lower incidence of black tip (*Alternaria*) infection which permits higher extraction rates and less loss of semolina during air purification to remove black specks.

It is anticipated that TAM 36A will be released later this year and sufficient seed will be available in 1978 to sow approximately 4 000 ha.

Last season close to 6 000 breeding lines were screened and 300 crosses made. Conditions were ideal for the development of a rust epidemic and all the breeding lines were subjected to the common field strains of leaf and stem rust. In addition, 500 lines were seedling and field tested at Castle Hill under the National Rust Control Programme.

Breeding for rust resistance: A stem and leaf screening laboratory has been established at Tamworth recently. Breeding lines from the durum and bread wheat programmes at Tamworth are being tested with pathogen strains collected in the field. In order to increase the number of possible persistent resistance sources available to breeders, a genetic analysis of certain emmer and durum cultivars has been undertaken.

The Australian Wheat Collection

This Collection services wheat researchers in all parts of Australia. Its duties are to import, maintain and distribute seed and to collect and collate data about accessions, as well as serving as a centre for the preservation of wheat genes for future generations.

WHEAT QUALITY

Investigations at the Agricultural Research Institute, Wagga Wagga, have shown that the relationship between flour protein content and bread baking score for Mexican introductions and their derivatives is completely different graphically, both in slope and intercept, to that shown by varieties of Australian origin. The impact of this on wheat breeding programmes in relation to wheat quality criteria is being closely studied. For plant breeders' material to be reliably assessed for baking quality, the results indicate that the protein levels of the test material are more critical than previously.

At the Agricultural Research Centre, Tamworth, studies on durum wheat have found that durum flour can be manufactured into a range of readily saleable products, such as soup thickeners, custard fillings, short pastry, pie and pizza pastry. Durum flour is a by-product from the semolina milling process, for which there is little demand.

Work on artificial grain drying at the Agricultural Research Centre, Tamworth, indicates that if damage to germination is to be avoided, temperatures of 40–45° C should not be exceeded until moisture content is down to 15 per cent, and even then 60° C should be the upper limit.

The recording pearling resistance (pearlograph) technique, developed at the Biological and Chemical Research Institute, Rydalmere, is proving valuable for studies on grain hardness, particularly in relation to estimating the optimum amount of water required to condition the grain prior to milling. The uptake of moisture by the grain after wetting has been observed, and the time taken for equilibration measured. Significant varietal differences have been noted using the pearlograph technique.

The new rapid starch damage method developed at the BCRI, has been found to be suitable for usage on flours milled from spouted grain. Using this new method it is now possible to blend spouted grain (normally down graded to stock feed grade) with sound wheat to produce a bakers' flour. Further work is aimed at studying various small-scale milling and grinding machines to adapt the new starch damage method for use as a plant breeders' screening test.

WHEAT PRODUCTION AGRONOMY

Mineral Nutrition

Wheat yields were increased by nitrogen (N) in six of seven experiments conducted in the southwest irrigation areas. Phosphorus (P) deficiencies were less common, yields being increased by P at only three sites and by only small amounts. Grain

protein levels were raised by N fertilizer but not sufficiently to make the grain unsuitable for biscuit manufacture. In other experiments, an increase of 1.1 per cent of grain protein content resulted from each 40 kg/ha of N applied at anthesis.

N fertilizer trials were conducted in southern New South Wales to apply the findings of earlier soil testing research to commercial situations. Nitrate content of the top 30 cm of soil has not been a reliable indicator of N responsive sites, although this test gave good results in research from 1967 to 1970. A second study has shown that nitrate levels in the top 10 cm of soil fluctuate widely during the summer and autumn, whereas values for the top 30 cm are more stable.

In a trial at Yass, wheat yields of 2 cultivars were increased by P, but there was little residual response to superphosphate applied to the previous year's wheat crop. Positive N responses were recorded, unlike 1975 when N depressed grain yield.

Cultural Practices

Time of sowing: At Narrabri, irrigated Timgalen wheat sown at fortnightly intervals maintained yields of 3 t/ha until the last week of July, then declined to 1.5 t/ha for September sowings. Yields were highest at the lowest seeding rate used (24 kg/ha), which is similar to findings under dryland conditions.

Minimum tillage: Minimum tillage and reduced tillage treatments gave similar yields to conventional cultivation in three trials in the Wagga area. Seeding attachments are being developed to ensure successful establishment of wheat sown into previously undisturbed soil. Measurements taken after four successive crops showed that where minimum tillage was used, soil structure measured as per cent aggregation was superior to that where three cultivations were used prior to sowing. Less crusting was observed after heavy rainfall, and resistance to the passage of a tine was much less in the minimum tillage plots.

Fallowing: In five experiments in the central-west, four lengths of fallow (commencing from September, 1975, to May, 1976) were compared. Long fallows decreased the number of annual grass weeds, and increased the amount of available soil nitrogen. Yields for the February and May commencements averaged only 72 per cent and 50 per cent respectively of the longer fallow yields.

Stubble retention: Experiments at two sites in the north-west compared surface stubble retention with incorporation and burning. On the red-brown earth site, stubble retention reduced erosion prior to sowing, but yields were highest on the burnt plots and lowest where stubble was incorporated. On the dark, cracking clay site, heavy stubble residues at sowing time reduced plant growth, and grain yields were 20 per cent lower than on the burnt plots. No differences in moisture retention were recorded, ample moisture being stored in all treatments, and there was no response to nitrogen at either site. In a related study on the effect of row spacing, wheat yields at 18 cm and 27 cm were similar, but yields were 9 per cent lower at a row spacing of 36 cm.

Soil ameliorants: Residual effects of gypsum were again observed on hard-setting soils in the Gwydir Valley. Surface crusting was reduced and wheat yields increased where gypsum was previously applied at 12 t/ha. Smaller yield responses were obtained at 1.25 and 2.5 t/ha, and gypsum at these rates may give economic amelioration.

Grazing management: Feed production from early sown wheat was sufficient to give weight gains for four weeks where sheep were grazed at 20 /ha, despite the dry winter. Grain yields for wheat grazed at this stocking rate for two weeks and four weeks averaged 93 per cent and 80 per cent of ungrazed plots respectively.

WHEAT DISEASE

Seed-borne Fungi

The resistance of wheat lines to bunt (*Tilletia caries* and *T. foetida*) is tested at Wagga as part of a breeding programme to develop resistant varieties. Using isogenic lines, the gene *Sr26* for stem rust resistance was found to reduce susceptibility of wheat to bunt. Six races of *T. foetida* and 4 of *T. caries* were identified when 50 bunt collections were inoculated onto differential wheat lines.

The fungicides MEB 6447, EL 228 and Furavax ® gave good control of soil-borne bunt. Panoram ®, Furavax ® and MEB 6447 were better than or equal to carboxin for control of loose smut of barley.

Take-all

In Tamworth field trials, an avirulent *Phialophora* gave similar protection to wheat against take-all (*Gaeumannomyces graminis* var. *graminis*.) Other trials demonstrated that var. *graminis* does not survive as well in soil as the pathogenic var.

tritici. The inefficiency of protection in the field could be due to the slower growth rate of var. *graminis* at low temperatures compared with that of the pathogen.

Cereal Cyst Nematode

The spring wheat line Aus 10894 and the line Loros (Aus 11577) were partially resistant to the cereal cyst nematode (*Heterodera avenae*). A new symptom, blackening of the swollen sites of nematode invasion, was observed on wheat roots. The underbridge-like structure in females and young cysts of nematodes from Australia and Europe is probably derived from the uterine chamber. It does not persist in mature cysts.

Wireworms

The importance of wireworms is increasing with the wide-spread adoption of stubble mulching and summer cropping which provide suitable habitats for survival of wireworms. Two generations of false wireworms occur each year: A short generation of 4–5 months during spring-summer and a longer one of 7–8 months from autumn to spring. Adults live for about 1 year and females lay eggs two or three times. The insecticides carbofuran, Miral ®, oftanol, phorate, chlorfenvinfos and terbufos controlled false wireworm (*Pterohelaeus darlingensis*) at low rates in pot trials.

Septoria Leaf Blotch

The demonstration that *Septoria tritici* can cause yield losses of 30–50 per cent in wheat has led to the formation of the Septoria Task Force at Wagga to co-ordinate work on this problem. This group comprises two plant pathologists, a geneticist and three wheat breeders, and aims to develop resistant varieties. An Australian Septoria Nursery was developed in co-operation with workers in other states and sown at six locations throughout Australia, including Wagga and Temora. The nursery yielded some wheat lines with promising resistance to *S. tritici* throughout Australia. These could prove useful in a breeding programme.

Black Point

Significant differences were found in the resistance of wheat varieties to black point in field trials. Black point is a serious problem of durum wheats in northern New South Wales. The fungus *Alternaria alternata* is associated with about 60 per cent of affected grain while other fungi occur in the remainder.

OAT IMPROVEMENT

The oat improvement programme at Temora Agricultural Research Station is directed mainly at producing improved dual purpose oat varieties for New South Wales. However, some attention is also given to developing non-grazing types for grain only production.

Irregular seasonal conditions hampered selection and testing. Also, very heavy stem rust (*Puccinia graminis* f. sp. *avenae*) infections in plots and breeding rows adversely affected grain quality. This effectively screened for stem rust resistance, and will result in highly susceptible material being rejected from the programme.

Several advanced lines which performed well have been forwarded for widescale testing by agronomists in district trials in 1977. M2361 (P4315 selection 5–1974) and G72/36 are both dual purpose types intended for early sowing and heavy grazing. They are both strong strawed and possess some resistance to stem rust from the variety "Garry". M2244 (Kent/Orient/Coolabah) and M1366 (Miljee/2* Coolabah) are intended for midseason sowing with lenient grazing and subsequent grain recovery. An introduced variety "Coronado" has also been forwarded for testing at selected sites as a leniently grazed variety. In 1975 and 1976 seasons Coronado demonstrated effective rust resistance, strong straw and good grain yielding ability and quality at Temora Agricultural Research Station.

The 1975 and 1976 International Oat Rust Nurseries were tested in co-operation with Sydney University to assess the usefulness of the resistance genes available.

Detailed observations were made on all Australian oat cultivars released since the publication of the booklet "Identification of oat varieties in New South Wales". At least one more season's observations are required before the booklet can be updated.

BARLEY IMPROVEMENT

Fifteen advanced cultivars were included in widescale barley variety trials. One of these lines, B6671, a Victorian crossbred, is being considered for release as a replacement for Lara in both Victoria and New South Wales. In central and northern

New South Wales where Lara yields considerably more than Clipper, B6671 has given yields well above Clipper and comparable to Lara. B6671 has lower screening losses than Lara because of its larger grain size which is intermediate between Lara and Clipper. It is currently undergoing a second year of industrial testing and laboratory tests indicate that it will be suitable for malting. Seed supplies are being increased in 1977 for possible release in 1978.

Two other advanced crossbreds are also being considered for future release in northern New South Wales, namely Cutter and B6513. Cutter, bred at the Waite Institute in South Australia, is being considered for release as a replacement for Clipper in central and northern areas. In these areas Cutter yields substantially above Clipper. It is a sister line to Clipper, with similar maturity. It has large grain and a white aleurone. It is named as a variety because it has been released as "Cutter" in Rhodesia where it is acceptable for malting. Seed supplies will be increased in 1977 for large-scale industrial testing prior to possible release in 1979.

B6513 is a Victorian crossbred selected in New South Wales for possible release as an earlier maturing variety than Clipper. It has consistently yielded better than Clipper in central and northern areas of New South Wales. In some seasons it has also been superior in southern areas. It is two row, white, intermediate in grain size between Clipper and Lara, and because of its early maturity is unlikely to suffer excessive screening losses.

Seasonal conditions were unfavourable for determining forage production potentials in preliminary barley grazing trials although useful information was gained about varietal performance after grazing. Other preliminary trials enabled selection for yield and grain quality to be carried out.

Resistance to Covered Smut

In the 1975 season, covered smut collected from a large number of crops was used to detect resistance in a range of barley varieties and introductions. This project was continued and the varieties Pennier, Tas. 72-958, Tas. 72-889, and Tas. 71-1016 were identified as being highly resistant while Lenta and Beka were classed as resistant.

MAIZE AND SORGHUM

Maize Breeding

A new single-cross hybrid GH5004, bred at the Grafton Agricultural Research Station, performed very well in district trials and will be released for commercial production. It is 3 weeks earlier than the widely-grown hybrids GH128 and GH390, is resistant to northern leaf blight, maize dwarf mosaic, and ear rots, and has a good husk cover. GH5004 produces smaller plants than GH128 and GH 390, which facilitate machine harvesting, and decreases lodging.

Experimental late-maturing hybrids GH420 and GH422 continued to perform well in district trials on the North Coast, with average yields from five sites of 10 017 and 9352 kg/ha, respectively.

Experimental inbred lines were again screened for their reactions to northern leaf blight (*Drechslera turcica*) at Grafton Agricultural Research Station. Twelve South African lines with the resistance gene *HtN* were screened for the first time; of these two developed wilt-type (susceptible) lesions at anthesis, and 4 weeks later the disease had caused moderate leaf necrosis in one line only. Further assessment of this resistance will be carried out. Maize with the resistance gene *Ht1* again exhibited a susceptible reaction, indicating the continuing presence of a second race of *D. turcica* initially reported in 1975.

Plant Nutrition

Phosphorus and Nitrogen: Laboratory, glasshouse and field experiments are being carried out from the Agricultural Research Station, Glen Innes, to investigate the nutrition of summer crops on a range of soils on the North-West Slopes, in an attempt to more accurately assess fertilizer requirements from soil test results. Bray P-1, Olsen and Colwell soil phosphorus (P) tests are being compared over the range of soils, at different P fertility levels. Applied P increased soil test values for all methods, but the magnitudes of the increases varied among soils and methods.

In a sorghum field trial in 1975-76 applied P did not increase grain yield. However, yield responses were measured with nitrogen (N) applications of up to 100 kg/ha, probably due to low soil nitrate-N, a shallow top-soil, and sufficient rain to prevent moisture stress. Six trials with grain sorghum were sown in 1976-77, comparing four rates of N and five rates of P application. No responses to applied P have been observed but responses in growth to applied N have been observed in five of the trials.

A simple technique of strip applications of N and/or P before sowing is being investigated by the Tamworth Agricultural Research Centre, as a method of surveying the extent of N and P deficiencies on the North-West Slopes. No growth response to applied fertilizer has been observed at 10 different sites.

Zinc: Maize yield increases of 100 per cent are being maintained after 5 years in plots which received a single application of 28 kg zinc (Zn)/ha in a trial at Breeza. Plots receiving a single application of as little as 6 kg Zn/ha are still yielding of 80 per cent of maximum yields, but are now showing an additional response to current Zn application.

Maize leaf analysis at tasselling is well related to Zn application and grain yield; however, whole-plant analysis of seedlings proved not to be a reliable indicator of Zn deficiency because of differential Zn accumulation in various parts of the seedlings.

Soil analyses of the plots in the Breeza trial were closely related to initial and current Zn applications and to leaf analysis at tasselling.

Weeds

A research programme was commenced in 1975 to examine the control of *Colanum karsenis* in grain sorghum at Lake Tandou, near Menindee. It appears that sorghum grown with adequate nitrogen fertilizer and irrigation may benefit from up to 3 kg atrazine/ha where this weed is present.

Insect Pests

Heliothis armigera, an important insect pest of summer crops, has developed resistances to a number of insecticides in northern New South Wales. A research project is being undertaken at Tamworth Agricultural Research Centre to study the genetics of these insecticide resistances, and to investigate cross-resistance mechanisms in insecticide resistant *Heliothis* spp.

RICE

Varietal Improvement

Many overseas varieties were introduced to broaden the genetic base of the rice breeding programme at Yanco. Twenty-five crosses were completed this year. Some of them aimed at producing an aromatic long grain, for which there is a considerable international market.

Pure seed schemes continued for Calrose, Inga, Kulu, Early Caloro and YR73, while two varieties were withdrawn from commercial production.

There are many problems associated with growing the commercial long grained varieties Kulu and Inga. Consequently a new long-grain YR73 has been developed, and is now available for release. It is an early maturing, short statured variety which yields better than Inga, has good millout and has better cooking characteristics than other commercial varieties. Commercially pure seed will be available for the 1978-79 season.

Exploratory work was conducted on the relationship between protein content and milling quality, and on the estimation of starch content and starch viscosity. These studies provide basic information to aid in the selection of new rice varieties, which will mill well and have acceptable cooking quality.

Agronomy and Physiology

Muddy water is a problem to some rice farmers. It has drastic effects on rice establishment especially under cool conditions. The problem can be alleviated by application of gypsum to dry soil prior to flooding. This increases the light penetration and raises the temperature at the soil water interface, thus promoting bigger and healthier plants at emergence.

Nitrogen is the only fertilizer required to successfully grow rice. There is no difference in response between the two commercial fertilizer products sulphate of ammonia and urea. However, timing of nitrogen application is a major factor in determining rice yields. Topdressing prior to permanent flood leads to better rice growth and yields. This practice has now been adopted by the industry.

Studies have continued to identify problems associated with the management, agronomy, pathology, nutrition and hydrology of continuously cropped rice. There have been no management, hydrology or disease problems. Superphosphate had no effect on increasing yields in the year of application, but there was a trend to higher

yields from plots which received superphosphate in the previous year. Successive increases in applied nitrogen (up to 225 kg ha⁻¹) caused significant yield increases with no residual effects the following season. It appears that the continuous cultivation of rice will pose no extraordinary problems to farmers.

Studies at Yanco showed that the addition of carp to a rice crop had no detrimental or beneficial effect on the growth and yield of rice plants.

An experiment was done to study the effect of water stressing in a vigorous crop of Inga during the vegetative phase in order to reduce growth and prevent a loss in grain yield. Stressing prior to panicle initiation substantially reduced growth and had a beneficial effect on grain yield.

Straw through the header during rice harvest can cause grain loss. In previous years the use of desiccant reduced the amount of straw, but this year no beneficial effect on yield. The desiccant treatment resulted in a more rapid loss of moisture from the grain and this probably had an adverse effect on grain quality.

Crop Protection

Aquatic snails (*Physastra* spp.) have persisted as a major threat in some areas of Coleambally and southern Riverina. Copper sulphate offers effective control but has adverse side effects on sheep grazing subsequent pastures. This year an alternative molluscicide, niclosamide, at 0.25 p.p.m. controlled aquatic snails in tillering rice. It had no adverse side effects on other aquatic life forms.

About 80 per cent of rice seed in the Riverina is dressed with DDT and the fungicide captan. A replacement for DDT is sought for environmental reasons. Already temephos has replaced DDT as the insecticide introduced into water in rice bays to control active infestations.

Two species of *Pythium* were shown to cause damping off in rice. This can be a big problem in seedling establishment in some seasons. Evidence suggests that captan is still the best seed dust to use.

Cyperus difformis (dirty dora) is a major weed in rice bays. While its germination is greatest in shallow water, it can also germinate and grow in depths up to 30 cm. Japanese workers found that morphactin, CF 125, will control this weed. The combination of morphactin with $\frac{1}{4}$ to $\frac{3}{4}$ of the recommended rate of molinate can also control *Echinochloa* spp. (barnyard grass), the other major rice weed. Morphactin (0.5 kg ai/ha) alone or in combination with molinate, had no effect on aerially sown rice plants when applied either prior to sowing or at 4 to 6 weeks after sowing.

PESTS OF STORED GRAINS

Stored Grain Insects on Farms

Grain Fumigation: Carbon bisulphide fumigation of grain in farm silos was investigated by entomologists from Rydalmere, Temora, and Condobolin. A plastic silo cover was compared with sealing grain outlets only. Fumigant was sprayed over the grain surface in 73 m³ silos after inserting caged *Sitophilus oryzae*. Fumigated silos at Condobolin were heavily infested by *Rhyzopertha dominica* and *Tribolium castaneum*. Fumigation for 24 hours with 60 ml/m³ carbon bisulphide at Temora (16–40° C) and 120 ml/m³ at Condobolin (5–33° C) controlled adult insects in the covered silos. Few progeny survived at Temora and none at Condobolin. Fumigation in partly-sealed silos was ineffective.

Grain protectants: Entomologists from the BCRI commenced a grain protectant trial in farm silos at Condobolin A.R.S. in December with synergized pyrethrum/maldison treated wheat and barley, synergized pyrethrum/dichlorvos treated wheat, maldison treated wheat, synergized pyrethrum treated wheat and untreated barley. Treatment rates were 3 p.p.m. pyrethrins, 12 p.p.m. maldison and 6 p.p.m. dichlorvos. Field results for 5 months storage indicated that synergized pyrethrum alone, or combined with maldison or dichlorvos, prevented *T. castaneum* and *R. dominica* infestation. In laboratory bioassay with maldison-resistant insects after 2 months, these treatments controlled adult *R. dominica*, *S. oryzae* and *Oryzaephilus surinamensis* but not adult *T. castaneum* and *Ephestia cautella* larvae. Only *S. oryzae* succumbed in maldison-treated wheat. Maldison residues were mainly < 5 p.p.m.; dichlorvos residues were < 0.1 p.p.m.

Header disinfection: Insecticide aerosols and smoke generators were compared by an entomologist from the BCRI for disinfecting header-harvesters at Tamworth Agricultural Research Centre in April. Aerosols of 20 per cent dichlorvos or synergized pyrethrum (0.4 per cent pyrethrins), dissolved in carbon dioxide, were applied from pressure cylinders to headers at four points, with a crevice nozzle, to test dispersion. Dichlorvos vapour controlled caged maldison-resistant *T. castaneum* and maldison-susceptible *R. dominica* but not resistant *R. dominica*. Spot treatment with synergized

pyrethrum aerosol was ineffective. Pirimiphos-methyl smoke from three generators (totalling 34 gm active ingredient), strategically placed, reached insects caged at four points in a header, controlling both species at two points.

Silo disinfection: A 20-gm pirimiphos-methyl smoke generator tested by an entomologist from the BCRI for disinfecting empty farm silos at Temora A.R.S. in April controlled maldison-resistant *T. castaneum* caged at four places inside the wall of a 73 m³ silo but not maldison-susceptible *R. dominica*.

Insecticide Resistance

Resistance survey: An 8-year survey at the BCRI, which revealed widespread maldison resistance in various grain insects, and dichlorvos resistance in *R. dominica*, was concluded. This year only nine samples of *R. dominica* were received from bulk wheat storages; six were diagnosed dichlorvos-resistant, two suspect resistant and one susceptible. *R. dominica* from farm-stored grain, Grenfell, February and from sorghum seed, Dubbo, April were resistant to maldison and dichlorvos.

Resistance range: Fifty *R. dominica* cultures were tested at the BCRI for resistances associated with maldison and dichlorvos resistance. Dichlorvos-resistant cultures were also resistant to maldison, fenitrothion, chlorpyrifos-methyl, methacrifos and phoxim, but not to bioresmethrin, synergized pyrethrins or lindane. Results for maldison-resistant, dichlorvos-susceptible, cultures confirmed that the resistance in maldison-resistant, dichlorvos-susceptible, cultures confirmed that the resistance is showed no general increase in dichlorvos resistance level despite escalation of the problem over that period. Resistance factors differed greatly within each year of collection, ranging over 4 years from x0.2 to x1.4 (mean x0.94).

Stored Product Moths: Larval samples of *Plodia interpunctella*, *Ephestia cautella* and *Ephestia kuehniella* tested at the BCRI with DDT, dieldrin, maldison and fenitrothion were mostly resistant to DDT and dieldrin. *P. interpunctella* and *E. cautella*, highly resistant to maldison, were less frequently resistant to fenitrothion. Two maldison-resistant samples of *E. kuehniella* were susceptible to fenitrothion.

Grain Protectant Trials in Grain Elevators Board Storages

Protection efficacy and residue studies were commenced at the BCRI on treatments adopted by the Grain Elevators Board for the 1976–77 harvest. Wheat treated with 12 p.p.m. dichlorvos and 1 p.p.m. bioresmethrin at Dunedoo silo averaged 0.2 p.p.m. dichlorvos after 3 months. Maldison-resistant *T. castaneum* survived in sample bioassay but resistant *R. dominica* succumbed. Neither species was found in the silo after 3 or 5 months. Wheat treated at Tichborne silo with 18 p.p.m. maldison and 3 p.p.m. synergized pyrethrins had 3–8 p.p.m. maldison after 3 months. Adult *T. castaneum*, resistant *R. dominica* and some susceptible *R. dominica* survived in sample bioassay. No infestation was found in the bin after 3 months but both species occurred after 5 months. Maldison/dichlorvos resistant or susceptible *R. dominica* succumbed in bioassay of wheat treated with methacrifos, chlorpyrifos-methyl/bioresmethrin, fenitrothion/fenoxithrin or pirimiphos-methyl/carbaryl from bulk storages in Queensland, New South Wales and Western Australia sampled soon after trials commenced.

PASTURES AND FORAGE CROPS

PASTURE ESTABLISHMENT

Establishment Methods

The role of an oats cover crop in the establishment and production of a newly sown pasture is being examined at Glen Innes. The effect of grazing by sheep and cattle on establishment and the value of the oat cover crop in providing extra grazing and/or grain in the first year of pasture establishment is an integral part of the project. Results to date indicate that the oat cover crop reduces establishment of grass plants but has little effect on legume establishment. The number of plants established was high in all treatments and the difference measured is unlikely to affect future pasture production.

Pasture Improvement

The development of techniques for the replacement of thistles, barley grass and associated nitrophilous weeds with lucerne, phalaris and cocksfoot is being examined at Orange. Research to date has shown that pretreatment grazing, herbicide treatment, time of sowing, split sowings and post treatment grazing are important in ensuring success. Surface sown lucerne, phalaris and other perennial pasture species have been successfully established amongst nitrophilous weeds and the improved species have gradually dominated the weed species.

Sodseeding Winter Pastures

The technique of establishing winter pastures of perennial ryegrass and white clover in areas dominated by kikuyu or paspalum using herbicides and a triple disc seeder is being examined. Glyphosate proved to be the most useful herbicide for suppressing kikuyu and paspalum in order to sod-sow winter pasture species. While 2, 2-DPA failed to kill kikuyu it changed the balance of the pasture in favour of clover which persisted well after treatment. The sodseeding techniques produced a pasture with equal winter productivity to pasture established by the more commonly used method of ploughing and broadcasting seed.

Research is determining the minimum rate of glyphosate required. Rates as low as 0.28 kg a.i. ha⁻¹ have successfully suppressed kikuyu and paspalum sufficient to enable winter pasture to be established. Higher rates of herbicide are required to obtain a complete kill of paspalum and kikuyu.

Pasture Species

A programme to select and evaluate species for the south coast and near tablelands with particular emphasis on pasture plants with improved winter growth is being conducted at Berry. The yield and persistence of a range of red and white clovers are currently being investigated, with a new low formononetin line of Quinequeli red clover being of special interest.

PASTURE MANAGEMENT

Natural Pastures

At Wollongbar Agricultural Research Centre, various techniques of improving carpet grass pastures were compared. Nitrogen fertilizer consistently increased the yield of the pasture grasses, notably that of paspalum, but the gains achieved may not justify the high cost of this treatment. The productivity of pastures topdressed with superphosphate and white clover was variable, being more sensitive than nitrogen-treated pasture to dry seasonal conditions and to damage by insects and diseases, but yielding more in favourable seasons. Kenya white clover (*Trifolium semipilosum*) and Haifa white clover (*T. repens*) were more productive pasture components than was Clarence white clover (*T. repens*). The application of asulam or 2, 2-DPA herbicides at appropriate rates suppressed carpet grass and favoured the growth of paspalum, white clover and broadleaf weeds.

From a long-term investigation conducted on sandstone soils in the Clarence River Valley, it is evident that the productivity of beef cattle grazing native pastures can be substantially improved. Recent results confirmed the pattern established earlier in the investigation. On unfertilized native pastures, heifers barely gained weight and they were not fertile at 18 months of age. Slight improvements in weight gain and oestrus activity were recorded in heifers grazing native pastures topdressed with superphosphate. Only when superphosphate was applied to native pastures oversown with white clover or white clover and lotononis was annual liveweight gain of heifers satisfactory, and these heifers were fertile at 18 months of age.

At Tamworth, the productivity and botanical composition of natural grass pastures grazed by sheep was found to be influenced more by seasonal factors and by stocking rate than by the quantity of phosphorus and sulphur fertilizer applied to them. Further studies are under way on the ecology of native perennial grasses, particularly those which produce sharp-pointed grass seeds capable of penetrating sheep.

At Trangie Agricultural Research Station, much research has been done on the management requirements and carrying capacity of various pasture types, including natural perennial, natural annual pastures, lucerne and barrel medic. Recently, a computer model of various pasture management systems for grazing sheep was developed, and this model will be used to help farm managers compare and predict the financial aspects of alternative management systems.

Improved Pastures

At Glen Innes Agricultural Research Station, experiments are continuing on an "ill thrift" problem commonly seen in weaners grazing improved pastures during autumn. It is suspected that, under certain conditions the protein in green, growing pastures is in a form which cannot be absorbed efficiently in the rumen of young sheep. Also at Glen Innes Agricultural Research Station, the effects of providing sulphur and sodium chloride licks to young cattle grazing immature sorghum—sudan grass hybrids was investigated. Results suggest that salt plus sulphur supplements will sometimes improve the liveweight gains of cattle grazing these hybrids.

Following research conducted at Berry, a farmer handbook was written to describe management techniques for improving the production and nutritive value of herbage produced from kikuyu pastures.

At Condobolin Agricultural Research Station, Merino sheep performed similarly on each of seven annual medic varieties, despite wide differences in botanical composition between the experimental pastures. Hannaford, Cyprus, Cyfield and to a lesser extent Akbar medics retained a high proportion of the original sown legume, while the medic component declined on Jemalong, Tornafeld and Borung pastures.

At Wagga Agricultural Research Institute, the measurement of beef production from lucerne/subterranean clover and from subterranean clover pastures is continuing. During 1976, when subclover performed poorly during a record dry spell in autumn and winter, cattle gained an average of 136 kg per head on lucerne/clover but only 47 kg on clover pasture. In another lucerne mixture experiment it was found that pasture productivity in summer and winter, lucerne density and clover seed production were influenced more by the companion species sown with lucerne than by varying the density of the lucerne component. Winter productivity was best from lucerne/Seaton Park subclover and from lucerne/subclover/Sirocco phalaris mixtures. Lucerne growth in summer was best in the lucerne/Geraldton subclover mixture. In a grazing experiment, large seasonal differences were evident in the intake and composition of the diet selected by sheep grazing a range of lucerne/subterranean clover mixtures, but wool and lamb production on "dense" lucerne (twenty plants per square metre) differed only slightly from that on "sparse" lucerne (five plants per square metre).

PASTURE PLANT NUTRITION

Diagnostic Studies

The fertility of the river flat soils declined, going from the upper to the mid-Hunter Valley, with responses to phosphorus and potassium at the furthest site below Singleton. Away from the river flats, pasture growth was boosted by sulphur on red basalt, grey clay loam and yellow solodic soils, by lime on a yellow sandy loam and by phosphorus on yellow solodic and grey podzolic soils.

In the lower Hunter, lucerne yield was quadrupled by effective inoculation and doubled by lime at one site. Small but consistent responses also came from molybdenum, sulphur and potassium at other sites growing lucerne.

From pot studies with two soils from the lower Macleay Valley, lime and copper increased phasey bean yields.

A glasshouse experiment at Glen Innes confirmed responses to sulphur in white clover growth.

At Condobolin, a new project has begun to define whether pasture legumes in the central-west are affected by the deficiency or toxicity of nutrients other than phosphorus and nitrogen.

Superphosphate

Plot and predictive studies: The development of fertilizer prediction models at Wollongbar and Wagga Wagga, and the evaluation of fertilizer test strips at Wagga Wagga and on the Monaro continued during the year.

Monitoring of soil phosphate levels in the Upper Hunter showed that the benefits of 400 kg/ha of superphosphate disappeared after 3 years.

Grazing Evaluations: At Singleton, subterranean clover and superphosphate almost doubled the liveweight gain of cattle over that from unimproved pasture and turned off the cattle in much less time.

In the fifth year of an annual rate of superphosphate x stocking rate trial at Grafton, apparent linear responses to superphosphate came from the medium and high stocking rates (2.5 and 3.3 steers/ha). Beef Production at 125 kg/ha superphosphate approached that of the 250 kg/ha rate.

Nitrogen

In experiments at Wollongbar, the residual effect of a single nitrogen fertilizer application in spring to a grazed kikuyu pasture was not affected by either the form of nitrogen (aqua ammonia or ammonium nitrate) or rates of nitrogen above 100 kg/ha. Over the seven years of a long-term experiment on beef production from nitrogen fertilized pastures, the response to annual nitrogen applications over time has virtually not changed, meaning that annual applications are needed to maintain production. In the past year, the loss of the white clover contribution from the nil nitrogen treatments reduced animal production by up to 48 kg/beast.

Further work at Wollongbar on the site effects influencing the spring response of tropical grasses to nitrogen showed that any advantage of early topdressing is limited by low temperatures which restrict growth. Using long-term climate records, the effect of climatic variation on the response of a tropical grass to nitrogen indicated increased dry matter responses from later topdressing when temperatures were warmer and from topdressing on wetter soils.

Potassium

Muriate of potash at 375 kg/ha lifted both clover production and animal growth in autumn-winter on a carpet grass-white clover pasture at Grafton. While the additional liveweight gain did not warrant the application of potassium, the improved clover content influenced the degree of finish of slaughter animals.

Mineral Content of Species

The effects of fertilizers and species on the mineral content of twenty-one tropical legumes and grasses were examined at Wollongbar. Addition of fertilizers had little effect on mineral content. Variability between species was greatest for calcium and sodium and least for phosphorus.

Nutrition of Native and Naturalized Species

Native perennial grasses and naturalized annual grasses and legumes from the North-West Slopes all responded to applications of nitrogen, phosphorus and sulphur at Tamworth. The maximum yield of the perennial grasses came from 100 kg nitrogen, 60 kg phosphorus and 10 kg sulphur/ha. Annual grasses yielded most from 50 kg nitrogen, 15 kg phosphorus and 10 kg sulphur/ha, while the legumes gave highest yields with both phosphorus and sulphur at 15 kg/ha.

EVALUATION OF PASTURE SPECIES AND FORAGE CROPS

Temperate Perennial Legumes

White Clover: The cv. Haifa white clover (*Trifolium repens*) has been better than Ladino and New Zealand at Glen Innes. At Taree, Haifa outyielded Ladino in winter and spring, while Pitau gave better late spring production than Ladino. At Grafton, early results showed the superior yield of Haifa to several South American accessions and naturalized ecotypes in mown sward evaluation. However, in a rotational grazing comparison cv. Safari Kenya white clover (*T. semipilosum*) was superior to Haifa which only yielded 70 per cent of that of Safari. The main advantage of Safari was in spring and summer production.

Red Clover: At Taree cv. Quinequeli red clover was superior to the cultivars Powera and Hamua over the winter-spring period. Summer growth was negligible in hot, dry weather.

Lucerne: Most previous work on lucerne, especially on cultivar evaluation, is now being confounded by recent identification of two aphids previously unrecorded in Australia. These two aphids, the spotted alfalfa aphid and the blue-green lucerne aphid, are causing serious widespread damage to lucerne and have caused a completely new appraisal of the lucerne situation. The most urgent research now needs to determine aphid resistant varieties and their adaptability.

A cultivar trial near Taree has shown Falkiner to be more resistant to aphid damage and waterlogging than Hunter River, Paravivo, Demnat, Siro Peruvian and Combined. Paravivo was more productive than Hunter River at Glen Innes in the first year.

Temperate Annual Legumes

Medics: At Taree, cv. Akbar barrel medic yielded more dry matter than snail, disc or button medic but button medic set the most seed due to 27 per cent Akbar pods containing no seeds. Regeneration at Glen Innes was poor although they have germinated this year. Medics sown in 1976 grew satisfactorily.

Subterranean Clover: Clare produced more dry matter than Seaton Park and Woogenellup at Taree and showed promise at Glen Innes but failed to establish from aerial seeding. Esperance, a scorch resistant variety, produced as much as Woogenellup near Wagga. *T. yanninicum* cv. Trikkala produced more dry matter than cv. Larisa at Taree and was most promising on granitic soil near Wagga. Trikkala, Larisa and Y155-3 were superior to Yarloop under flooding. *T. subterraneum* cultivars Woogenellup, Seaton Park, Daliak and Northam A were failures under flooding.

At Temora several new clover scorch disease (*Kabatiella caulivora* (Kirchn) Karak) resistant crossbreds produced more seed than Daliak and Esperance but were inferior in dry matter production to Seaton Park and Woogenellup.

Arrowleaf clover (*T. vesiculosum*) CPI 31884 gave good late spring growth and could replace berseem clover on poor dairying country on the north coast.

Sub-tropical Legumes

At Grafton several new species showed good seed yields, notably *Aeschynomene* spp., *Zornia* sp. *Lespedeza cuneata* and two lines of *Vigna vexillata*. The two lines of the latter species show promise as pulse crops.

Other plants showing potential as pulse or forage legumes are *Vicia* sp. CPI 66513 and *Vicia lutea* CPI 66510, both of which are, so far, disease free. Also *Lotus ornithopodioides* and *L. angustissimus* which are adapted to soils low in phosphorus. *L. corniculatus*, CPI 70533 from Ethiopia was more productive than Vega II, the previously best birdsfoot trefoil.

On the flood-prone rivers of the north coast three groups of plants warrant evaluation under grazing. There are *Lotus pedunculatus* an early flowering species from Portugal, *L. uliginosus* and an annual *L. hispidus*. All of these are free seeding and have an extended growing season.

Grasses

Paspalum plicatum var *villosissimum* and var *plicatum* gave high levels of production with little legume association at Grafton. Other noteworthy grasses were *P. wettsteinii* and *Digitaria pentzii* and *D. swazilandensis* lines. There was better legume association with the *Digitaria*'s than the more vigorous *Paspalums*, but carpet grass (*Axonopus affinis*) has even better legume compatibility.

Setaria anceps cv. *Narok* and CPI 19915 were the best of a range of *Setarias* at Grafton and *Narok* and *Cenchrus ciliaris* cv. Q10077 were the best of a number of grasses at Taree.

At Glen Innes *Siroa phalaris* was superior to Australian and Hybrid *phalaris* and *Demeter Fescue*.

Evaluation of native perennial pastures of the north-west slopes has shown that *Bothriochloa macra*, *Sporobolus elongatus*, *Dicanthium sericeum*, *Chloris truncata* and *Aristida ramosa* produce very little green leaf in winter. The most important native perennial grasses for grazing in winter-spring are *Danthonia linkii*, *Stipa variabilis* and *Eragrostis leptostachya* which produce green leaf high in crude protein during this period. As most of these species are winter dormant and frost susceptible fertilizer has little effect on these species.

Forage Crops

On low fertility soil at Taree, growth from winter legumes, particularly Purple Vetch (*V. benghalensis*), was superior to oats and ryegrass when nitrogen was not applied.

A mixture of oats and ryegrass yielded more forage than either alone. Saia oats was more productive than Algerian and ryegrasses on the coast, and Wimmera ryegrass was as good as or better than Kangaroo Valley, Tetila and Sabalan.

WEEDS OF PASTURE

Pasture Weed Model

A simulation model of weeds in pasture, based on an existing pasture model, is being developed. Work on the descriptive model will be followed by validation for variegated thistle on a whole farm system at Orange.

Weed Mapping

A system of recording weed distribution and ecological data was tested on Noogoora burr and Silverleaf nightshade and is now ready for testing on more widespread species.

Specific Weeds

Fireweed: The effects of fertilizer and grazing intensity on incidence of *Senecio latus* in pasture were studied at Wollongbar. Fireweed density increased with stocking rate but decreased on nitrogen fertilized pasture. Kikuyu grass invasion, induced by nitrogen fertilizer, reduced fireweed density.

Johnson grass: At Orange, investigations on the ecology and control of Johnson grass commenced in 1976. Aspects being studied include the relationship between environmental factors and distribution, ecotypic variation, dispersal and regeneration of the weed.

Thistles: A project commenced in 1977 to study the distribution, taxonomy, ecology and control of thistles infesting pasture and cropping areas of the State. As part of this programme the introduction of biological control agents will be assessed for the *Onopordum*, *Cirsium*, *Carduus* and *Silybum* genera.

Galvanized burr: Goats grazing at high stocking rates greatly reduced ground cover of galvanized burr but failed to prevent regeneration from buried seed. Assessments of a spineless form of galvanized burr and a biological control agent are being made as part of an ecological control programme.

Serrated tussock: Goats and herbicide tetrapion are being investigated for control of serrated tussock. As a result of grazing by goats, serrated tussock seed production has been reduced by 80 per cent. Tetrapion due to its year-round effectiveness is now preferred to 2,2-DPA which is only effective on tussock in January and February. An economic investigation is currently being made of the benefit and costs of public investment in control of serrated tussock on the Central and Southern Tablelands.

Silverleaf nightshade: The biology and ecology of this weed are being studied. Current work includes factors influencing germination, lateral spread and effects of herbicides for long-term control and for prevention of seed production.

INSECT PESTS OF PASTURES AND FORAGE CROPS

Spotted Alfalfa Aphid

The spotted alfalfa aphid (*Therioaphis trifolii* f. *maculata*) is a serious pest of lucerne in the United States. It was first recorded in New South Wales in early April, 1977, and during mid-late autumn caused very serious damage in all the lucerne growing areas. Populations built up to very high levels in the Mid Coast and Hunter, Central Western, and Western Regions. Winged forms dispersed over wide areas. In late autumn, heavy rain and frosts significantly reduced aphid numbers.

No wasp parasites or fungal pathogens were found during a survey of affected areas, but large numbers of predatory Coccinellid beetles and lacewing larvae caused marked local reductions in aphid populations in the Western and Mid Coast and Hunter Regions.

Field trials showed that low rates of acephate, chlorpyrifos, demeton-S-methyl, diazinon, dimethoate, formithion, maldison, methamidophos, methoxychlor, monocrotophos, omethoate, pyrimocarb and thiometon, were effective. The chemicals gave about 7 days' residual protection under conditions of high reinfestation pressure, and over 4 weeks' protection when large numbers were not reinvading treated areas.

Blue Green Lucerne Aphid

The blue green aphid (*Acyrtosiphon kondoi*) is a serious pest of lucerne in the United States and New Zealand. It was first recorded in New South Wales in early May, 1977, and during early winter caused isolated damage to crops in the Mid Coast and Hunter, North Coast, New England, South Eastern and Illawarra and Central Western Regions. Populations increased and reports of damage became more frequent in mid-winter.

An *Entomophthora* sp. fungal pathogen was found attacking aphids during a field survey, but no parasitic or predatory insects were observed. Low rates of acephate, chlorpyrifos, demeton-S-methyl, dimethoate, formithion, methamidophos, pyrimocarb and omethoate effectively controlled the aphid, in a series of field trials conducted during early winter.

Australian Plague Locust (Chortoicetes terminifera)

A major outbreak of the Australian plague locust (*Chortoicetes terminifera*) occurred during 1976-77. In spring, hopper bands developed throughout the central western slopes and plains, lower Darling and Riverina. Extensive control measures were undertaken and bands in the Western Division were also aerially sprayed. Swarming occurred in early summer and adult locusts severely damaged Riverina rice and vegetable crops. The next generation of adults swarmed on the north west slopes and plains and in the central west during late summer. Then, in early autumn, swarms from the north west and Queensland moved into the central west and northern Riverina and produced extensive areas of egg beds. Third generation adults swarmed on a limited scale in the central west during mid autumn.

In November, 1976, and February, 1977, a series of field trials was conducted against hopper bands. Maldison, fenitrothion, diazinon, chlorprifos, phoxim and dibrom were compared with lindane, the standard insecticide, using both high volume and ultra low volume application techniques. Further trials are necessary to establish final comparison of chemicals.

Migratory Locust (Locusta migratoria)

The biology and control of the migratory locust (*Locusta migratoria*), a significant pest of pastures and cereals in north western New South Wales, is being investigated. There are three generations each year. Overwintering eggs hatch in September, and second and third generation eggs hatch in late December and early April respectively. A localized but serious outbreak of the locust occurred in autumn, 1977, and trials showed that 600 ml/ha ultra low volume maldison would control the hoppers.

Yellow-Winged Locust (Gastrimargus musicus)

Over the last three seasons, the yellow-winged locust (*Gastrimargus musicus*) has become an increasingly important pest of pastures on the Tablelands. A study of the biology of the pest and the factors regulating population increase has been commenced. Only one generation occurs annually. Overwintering eggs hatch in early summer and adults are present from mid summer until late autumn. Egg laying occurs during late summer and autumn. Field observations have indicated that the egg parasite (*Scelio bipartitus*) may complete up to three generations during the oviposition period of *G. musicus* and achieve a high level of parasitism. Plant roots may also disrupt egg pods and reduce egg survival during winter.

White Fringed Weevil (Graphognathus leucoloma)

The white fringed weevil (*Graphognathus leucoloma*) is a major pest of lucerne and clover pastures. In preliminary pot trials, two non-residual insecticides—terbufos and CGA12223 (Miral®)—have shown promise as soil treatments for the control of *G. leucoloma* larvae.

Ecological studies have indicated that it may be possible to control the white fringed weevil by spraying transient insecticides to kill the newly emerged immature adults. Fourteen chemicals—azinphos-ethyl, carbyl, chlorprifos, chlorpyrifos-methyl, diazinon, dimethoate, fenitrothion, leptophos, methidathion, methomyl, monocrotophos, phosmet, phoxim and pirimiphos-ethyl—exhibited high toxicity to adult white fringed weevils in laboratory tests, white maldison, trichlorphon and endosulfan were less effective.

Black Cutworm (Agrotis ipsilon)

The black cutworm (*Agrotis ipsilon*) is a spasmodic, though often serious, pest of improved pastures and cereal crops in coastal districts. In two small-plot field trials at Rydalmere, late-stage *A. ipsilon* caterpillars were controlled by 0.56 kg ha⁻¹ chlorpyrifos, 0.56 kg ha⁻¹ leptophos, 0.56 kg ha⁻¹ methomyl, 0.75 kg ha⁻¹ endosulfan, 1.12 kg ha⁻¹ DDT, 1.12 kg ha⁻¹ trichlorphon and 2.24 kg ha⁻¹ carbaryl.

LIVESTOCK AND LIVESTOCK PRODUCTS

SHEEP AND WOOL

Management

Grass seed infestation of sheep: Studies have continued at Tamworth Agricultural Research Centre into the long-term effects of grass seed damage in skins and carcasses. An economic assessment of the losses caused by seed will be undertaken when research into the extent and nature of damage is completed in cooperation with other centres.

Computer models: Two computer models have been developed which show good agreement with field results. One relates to irrigation requirements for summer crops in the M.I.A. The second is an analysis of kikuyu growth patterns on the South Coast. Both of these can be used to determine the inputs necessary to optimize yield.

Management of ewes and lambs fed on grain: Officers at Glenfield have shown that lambs allowed a creep feed have the best growth rates when sheep are being hand fed. They performed better than lambs fed with their dams or weaned lambs. Weaned lambs did perform slightly better than lambs only being fed with their dams.

Effects of breed on carcass: Research at Temora and Trangie Agricultural Research Stations has shown that breed does not make any difference to fat distribution in a sheep carcass. There are some variations in bone distribution due to breed and sex, but these are only small.

Production of carpet wool: Assistance is being given to producers in establishing this new enterprise. Current research aims to identify zygoty, define the mutant gene expression and investigate aspects of wool quality.

Prevention of lamb loss: The selection of sheltered lambing paddocks can greatly reduce lamb losses. The natural features most important to overcome the effect of bad weather are being defined for the Central Tablelands area. Similar features should have the greatest influence in other areas.

Dorset production championships: Competitions held in the Central West and New England are being used to demonstrate the benefits that can be obtained from using measurement in stud breeding. Results in both areas show a large variation in performance of animals from the same stud. The degree of variation is greater with a stud than between studs.

Carcass appraisal: Traditional carcass grading based on weight, fatness and shape has been found to account for as little as 4.2 per cent of tenderness variation in lambs. Fatness has an effect on trimming but carcass length does not significantly affect yield of saleable meat. At constant fatness and length, however, carcass weight is closely related to yield.

Whole farm systems for intensive lamb production: Intensive lamb production on irrigated farms, with artificial rearing of very early weaned lambs, has been further developed at Leeton. Work is now moving towards controlled intensive reproduction and continual rebreeding.

Nutrition

Protected protein supplements: Attempts to overcome "weaner ill thrift" at Glen Innes were based on feeding protected protein to young sheep. Growth rates of fish-meal-supplemented sheep were 2 to 3.6 times the rates of non-supplemented sheep. It is suspected that the solubility of proteins in improved pastures is affecting nutrition.

Supplementary feeding: Young sheep on improved pasture fed either grain or allowed a block lick grew better than non-supplemented sheep. There was no difference in wool growth between any groups and the group allowed the block had depressed reproduction rates at first lambing.

Survival feeding of pregnant ewes: After testing five dietary treatments, it was found that a mix of 46 per cent wheat and 54 per cent hay (based on energy content) gave the best milk yields, lamb growth rates and lamb survival. One hundred per cent wheat diet was unsuitable.

Nutritional management of breeding flocks: This project is aimed at defining the limitations to wool growth in pregnant and lactating Merino ewes. Lambs from cystine supplemented ewes produced 10 per cent more wool. This appeared to be from greater fibre length, and higher follicle density in the lambs' skin. Direct supplementation of the lambs with cystine (or thyroxine) did not give any result.

Dehydrated poultry manure (D.P.M.) as protein supplement: Sheep supplemented with D.P.M. had improved production over unsupplemented animals when roughage was of low protein, but their performance was below animals fed a sunflower seed meal supplement. The low cost of D.P.M., however, may allow a net economic advantage over other protein supplements.

Introductory feeding of cereal grain: Attempts to understand the aetiology of grain poisoning have shown that sheep fed rapidly increasing amounts of grain have increased ammonia and reduced pH in the rumen. Roughage level in the feed had little effect on pH or V.F.A. content in the rumen.

Selenium and iodine supplementation: Selenium continues to give production responses on New England trials. Iodine gave an improvement in the survival of twins but no other areas of increased production were recorded.

Use of ruminants for straw disposal: Processing and chemical treatment will be used on cereal residues to increase their utilization by ruminants. This is aimed at economically and efficiently using cereal straw as an alternative to burning or mulching.

Genetics and Breeding

Selection for higher fertility: Merinos selected for higher fertility, wool production and lamb growth have shown 3 per cent per year increase in lambs weaned per ewe joined. Wool and liveweight increased by 1 per cent per year.

Efficiency of wool production: Selective breeding for increased clean fleece weight increased fleece production per unit skin area, and improved the efficiency of converting feed into wool. The advantage of the superior sheep increased as nutrition improved.

Genetic predisposition to pneumonia: Over six years the occurrence of pneumonia in selected flocks at Cowra has been 28 per cent and 65 per cent for the low and high incidence flocks. Although bacterial agents have been identified in the lungs, these are not thought to be the primary causative agents.

Border Leicester improvement: The flock developed with 88 per cent Border Leicester genes has consistently given exceptional production with 150 per cent lambs born, 125 per cent lambs reared, only 5 per cent dry ewes, and ewe deaths at less than 2 per cent.

Cheviot x Merino comparison: As prime lambs sires, Border Leicester rams were better than Cheviots which were better than Merinos. For prime lamb dams, Merino ewes may be better than either Border Leicester x Merino or Cheviot, when spring lambing. This is dependent on wool prices. However, the Border Leicester x Merino is best when autumn lambing is practised.

Gulargambone breeding scheme: Production data from contributing flocks were examined to determine the extent that co-operative practicalities forced a reduction in rate of gain. By having producers contribute a set percentage of their maiden ewes, instead of those which were a defined level above the whole scheme's mean, the rate of potential response was only 80 per cent of that possible.

Selective breeding of Merinos: After 25 years' selection for clean hogget fleece weight, sheep at Trangie show a 25 per cent improvement over randomly selected sheep. However, the rate of response to selection has fallen and actual performance is below previous estimates. Also adult ewe fleece weights do not show the same gain as hoggets; for a 10 per cent increase in hogget greasy fleece weight, adult ewe weight increases 8 per cent. Selection has reduced crimp frequency, increased fibre diameter and yield, but has had no effect on fleece rot.

Merino breeding plans: From an examination of official stud flock registers, the gene flow between tiers and within the study industry was estimated. The flow was found to be much less than commonly portrayed, with daughter and general studs using up to 95 per cent homebred rams.

Reproduction and Fertility

Reproductive modelling: A mathematic model has been produced to allow estimates of the causes of reproductive wastage. Field testing of the model on a commercial flock, which has 83 per cent maiden ewes dry and 27 per cent adult ewes dry, identified the areas where the wastage occurred. In the adult ewes, 30 per cent of the wastage was from failure to mate, and 70 per cent from early embryonic mortality. With the maidens, 34 per cent of the dry ewes failed to mate, 14 per cent had fertilization failure, and 52 per cent had embryonic loss.

Frequency of feeding pregnant ewes: Ewes fed daily had slightly longer gestation lengths and higher lamb weights than ewes fed once or thrice weekly. Ewes fed three times a week maintained liveweight best up to 8 weeks after lambing. Frequency of feeding did not have any effect on lamb growth.

Ram dominance: Where dominant rams were infertile, ewes pregnant was reduced to 72.3 per cent, compared with 90 per cent when infertile rams were subdominant or all rams were fertile. The depression occurred despite sufficient fertile rams being present.

Stimulating mating performance: Trials at Shannon Vale demonstrate there is no advantage to be gained from using teaser rams before joining with either maiden or mature ewes. Even maidens raised from weaning with teasers present showed no response in fertility.

Predictions of Merino fertility: A method has been devised for predicting lambing results by taking measurements of performance during mating. These measurements require long periods of observation, but indirect methods of gaining mating data are being developed.

Productivity of single and twin born Merinos: Wool production and liveweight favoured single born ewes up to 30 months. Differences were small. Twin born ewes showed a higher reproductive rate throughout their life and this lowered their lifetime wool production slightly.

Rams of high v. low mating ability: High ability rams gave a more successful pregnancy rate in the early stages of joining. They had 77 per cent ewes pregnant in the first cycle compared with 58 per cent from the low ram ability group. Final total numbers after 6 weeks' joining were similar.

Hybrid vigour in lamb production: Trials at Agricultural Research Station, Cowra, have shown that crossbred ewes can produce 40 per cent more lambs than the average of the breeds they come from.

Evaluation of "Booroola" Merinos: Early results from CSIRO Deniliquin and Agricultural Research Station, Leeton, show the Border Leicester x Merino ewe to be better than "Booroola" Merinos for prime lamb production, with more wool produced, fewer ewe deaths and better lamb growth.

Sheep fertility service data analysis: This work will provide "norms" for the various fertility measurements that extension and research people use when investigating flock infertility. The base data have been gathered over 10 years while investigating numerous infertility problems involving many breeds in all areas of the State.

Management for reduced lamb deaths: Systems of closely supervised drift, split-group and unsupervised lambing were examined at Agricultural Research Station, Trangie. The system of split lambing groups with marking 1 week after the group completed lambing gave post marking losses of only 1.4 per cent, compared with 3 per cent and 6 per cent for drift and unsupervised systems.

Lambs from weaner ewes: Low lambing rates from ewes joined at about 8 months of age appear to be associated with mating inefficiencies as well as reduced oestrus. Liveweight affects the extent of both these problems.

Test for pregnancy: Tests which measure peripheral plasma progesterone have been used as indicators of pregnancy. Early results have been very accurate. Refinement of the technique is continuing.

Post Partum Mating: In attempting to rebreed ewes early after lambing the function of the pituitary gland and ovary were examined. Hormonal manipulation of both these allowed breeding soon after lambing, but fertility was too low to be economic.

Induction of Parturition: Oestradiol benzoate proved to be successful in inducing synchronized lambing. It was better than short- or long-acting corticoids. Lambs born after 140 days' gestation grew as well as full term lambs.

Survival of transferred eggs: Transfer on the third day after detection of oestrus in both donors and recipients has consistently given best survival results at Leeton.

Fertility studies: Maiden ewes have proved as easy to get in lamb as mature ewes if they are the same liveweight. However, mature ewes still produce more twins. Low maiden liveweight is associated with reduced incidence of oestrus and increased embryo mortality.

BEEF CATTLE

Price Stabilization Schemes for Beef

Possible price stabilization schemes for beef are being evaluated. Severe practical difficulties in establishing such a scheme exist. There are reasons to doubt that stabilization would alleviate beef producers' present financial problems, as they are mainly caused by an imbalance of supply and demand.

Deficiencies of Northern River Pastures

At Grafton Agricultural Research Station there are a number of research projects being conducted to examine the deficiencies of pastures in the Clarence River Valley. The measured organic matter digestibilities of five summer growing grasses were generally below 65 per cent. Values for *Setaria*, Carpet grass and Rhodes grass were so low that these grasses were considered not suitable for inclusion in a grass dominant pasture.

No biological or economical advantage was achieved by the application of superphosphate, unless native pasture was oversown with a legume. When yearling heifers grazed native pasture oversown with white clover, there was a significant increase in weight gain and the percentage of heifers in oestrus at 18 months. The inclusion of a second legume, lotononis, to the pasture gave a further significant increase in weight gain and increased the optimum stocking rate. Carcasses of steers on similar pasture treatments are to be analyzed to determine the mineral status of cattle after twelve months' grazing.

Superphosphate was applied to pasture annually at 125, 250 and 500 kg/ha for 4 years. Liveweight gain of cattle was unaffected by the fertilizer rate for the first two years after cessation of fertilizer application. In the third and fourth years, there was some advantage in liveweight gain on the pastures that were fertilized at the highest rate, but differences were less than 0.1 kg/steer/day.

Production Function for Beef

A study of data collected in a recent survey on the north coast is attempting to formulate a "production function" for beef, using factors which influence the income of producers other than the price of beef. Regression analysis of variables such as property size, herd size, area of pasture improvement and management skill will provide an insight into the current structure of the industry, and may suggest worthwhile areas for research and extension.

Irrigated Pastures

Several pasture mixtures are being investigated under irrigated conditions at the Agricultural Research Station, Trangie, in an attempt to find a mixture suitable for fattening cattle in the Macquarie Valley. Dry matter availability, pasture growth rate, pasture composition and animal liveweights are being monitored.

Copper Supplementation on Irrigated Pastures

Injections of 120 mg of copper glycinate monthly or six-monthly did not affect liveweight or blood copper levels in yearling steers on irrigated pastures at the Agricultural Research Station, Trangie. However the control group (nil copper) had blood copper levels that were regarded as only marginally deficient, and this may account for the treatment with copper having no effect.

Studies with Monensin and Elfazepam

The effect of the biologically active compounds monensin and elfazepam on the performance of beef cattle under grazing conditions will be studied in a trial which is to commence in August, 1977. Weaner Hereford steers will receive doses of monensin, elfazepam or a combination of the two from sustained release capsules. Both these compounds have been shown to enhance cattle performance on grain but little evidence is available on their effect under grazing conditions.

Correlated Responses to Growth Rate

Three selection lines have been established at Trangie Agricultural Research Station to examine the correlations between growth rate and other aspects which are important in beef production. Cattle are selected solely on corrected daily gain to 12 months of age in a High line (selected for fast growth rate) and a Low line (selected for slow growth rate). A random selection line where no intentional selection is applied on any character has been established as a control line. This project commenced in 1974 and will continue until there is sufficient difference between the High and Low lines to see the effect on other production characters.

DAIRY CATTLE PRODUCTION

Supplementary Feeding

A number of experiments have been conducted at the Agricultural Research Centre, Wollongbar, to evaluate the effects of feeding supplementary feedstuffs to dairy cattle grazing improved summer growing pasture. The high cost of most concentrate supplements (approximately 10 cents per kg) precludes their regular use. Despite milk production increases of about a litre per cow per day per kg of concentrate fed, the relatively low price received for that extra milk (around 4 cents to 5 cents per litre) negates any possibility of profitability. There is little doubt that the most efficient milk production systems are those relying solely on pasture and farm grown forage. Such a system is eminently suited to the coastal dairying areas of New South Wales.

A large grazing experiment is currently being conducted to evaluate the potential for milk production of a new leguminous forage crop—Weiko III sweet yellow lupins. Lupins have previously shown to possess a similar nutritive value to two other commonly employed temperate forages, oats and ryegrass. They have the advantage, however, of not requiring expensive nitrogenous fertilizer. Also, they can be sod sown into permanent pasture, thus minimizing risks of erosion by autumn rains.

The current experiments will evaluate the contribution of lupins at three stages of growth when fed at two rates to cows grazing either abundant or limiting levels of basal pasture. The experiment will run during the winter/spring periods of 1977 and 1978.

Lipid Rich Feed Supplements

During the development of techniques for the production of protected polyunsaturated lipid supplements for ruminants, CSIRO Division of Animal Production successfully manufactured spray dried decorticated oil seed/sodium caseinate homogenates. The product, resembling green coloured powdered milk, when treated with formaldehyde, provided an acceptable feedstuff which was substantially resistant to microbial degradation in the rumen of recipient animals and enabled significant quantities of polyunsaturated fatty acids to be absorbed from the gut and incorporated into milk and body fats.

A co-operative experiment with CSIRO was designed to evaluate some of the nutritional and physiological implications of feeding a spray dried safflower seed/sodium caseinate homogenate, either treated with formaldehyde or untreated, as a supplement to lactating dairy goats. The treated supplement increased about sixfold the levels of linoleic acid, the major polyunsaturated fatty acid in safflower seeds, in both the blood and milk fats. Milk production and milk protein levels were unaffected. However, milk fat yields and the yield of total milk solids were increased when the product was fed.

Genetics Research for Dairy Herd Improvement

This project aims to provide estimates of parameters necessary for the design and organization of dairy cattle breeding programmes under Australian conditions.

Accumulated records of the New South Wales dairy herd recording scheme have been used to prepare a research data bank. This in turn is being used to describe each breed for the major phenotypic variables, determine the relative contribution to variation in the economically important characters of other selected variables, and develop methods of data adjustment. Subsequently, genetic and other necessary parameters can be estimated from the adjusted data. These estimates will be used to improve the efficiency of regular processing of records of dairy herds and to design breeding programmes and determine their relative efficiencies.

This is an on-going project which was commenced in 1975. Descriptions of the major phenotypic variables and of other selected variables have been obtained for all popular breeds and two systems of recording from the prepared research data bank. These descriptions will now be used to initiate studies to determine methods of data adjustment.

DAIRY PRODUCTS

Milk Production

Procedures have now been developed for the measurement of hormones and other proteins in milk by radio-immunoassay.

Methods for machine milking sheep have been evaluated with a view to commercial milk harvesting from Australian crossbred ewes. The shape of the udder was more important than the milk ejection reflex in determining efficiency of milking. It should therefore be possible to milk ewes commercially without special handling to achieve milk ejection, provided they have been selected for udder shape. Other details of the milking management of ewes are currently being studied.

Factors influencing the order of cow entry at milking have been studied. Cows which consistently enter the shed in a particular place in the order tended to have significantly higher production than other cows. The implications for economic productivity of milking are being studied further.

Dairy Product Quality

Contamination of milk by iodophor sanitizers has been investigated. A simple method was developed for determining total iodine in dilute iodophors, and a common method for iodine determination in milk has been modified to improve the stability of the colour reaction, thus making it more useful in practice.

A technique for measuring the residual water in milking machines has been developed.

The retention and alteration of iodophors by different rubber, plastic and other materials used in milking machines have been quantified. It is apparent that much of the available iodine in dilute iodophors is lost by retention in rubber and plastic components.

The effect on somatic cell count of milk of administering stress hormones was found to be negligible in uninfected cows. Progress has been made with electronic instrumentation, which will monitor chemical changes in milk resulting from mastitis or from physiological causes.

Certain cheese starters have been found to inhibit the growth of pathogenic staphylococci during simulated cheddar cheese manufacture. The rate of growth of frozen concentrated cheese starter in milk has been measured using the new technique developed last year.

Psychrotrophic bacteria which cause milk spoilage have been isolated from milk deposits on farm equipment. A survey of the incidence of these milk deposits and their bacterial flora is continuing. The problem of cream plugging in milk has been investigated and, in this case, attributed to the spore-forming bacteria *Bacillus cereus*, the probable origin of which was brewer's grain used for feeding dairy cattle.

Dairy Product Development

Granulated milk co-precipitates have been successfully used for extending beef patties. The patties containing milk protein were judged to have better physical characteristics, appearance, flavour and texture in taste panel evaluation than all-meat or soya patties. Because of the relatively small amount of milk protein needed, they could also be cheaper.

The relationship between various protein analyses, physical qualities and processing conditions of processed cheese have been further delineated in a continuing project.

The incorporation of milk proteins into the manufacture of pet foods has also been satisfactorily achieved.

PIGS

Carcase studies

Survey of carcase measurements: Statistical analyses of the measurements of over 46 000 carcasses showed that P2 (the probe measurement taken 65 mm from the midline at the level of the last rib) was the measurement most closely related to all other measurements of carcase fatness taken in the survey. Because of this, and the consistent finding in other studies that probe measurements are superior to midline backfat measurements as indicators of carcase leanness, it was recommended that P2 should form the basis of a uniform system of backfat measurement in Australia.

The frequency distribution programme developed as part of the method of analysis has been used to develop grading systems. It now forms the basis of the carcase classification grid being incorporated into the automated pilot runs of pig carcase classification.

Development of a National Carcase Measurement and Information Service: While implementation of a manual recording system has been proceeding since mid 1975, added impetus was given by the 1976 decision of Agricultural Council to promote evaluation of carcase classification by providing funds for pilot trials of carcase classification for all species using advanced automated equipment. This equipment, incorporating a computer and printer located at the abattoir, permits preparation of buyer and producer statements plus management summaries at the abattoir. The Agricultural Council decision formalized the existing liaison between the separate projects of beef and sheep carcase classification and the pig carcase studies, by creating a supervisory committee on carcase classification for all three species.

Pig carcase classification in the automated trials is based on the frequency distribution approach developed in the 1973 survey, which was updated by using measurements collected by the South Australian Meat Corporation during 1976. The automated pilot runs will permit economic analyses to be made of the impact of the new equipment and to determine what size kills are needed to make automation a more attractive proposition than the existing manual procedures.

Nutrition

Available lysine studies: Initial experiments have demonstrated that there is considerable variation in the available lysine (and hence protein quality) of local sources of protein concentrates. The availability of lysine in meat meal, cottonseed meal and sunflower meal has been shown to be approximately half that in fish meal, soybean, rapeseed meal and skim milk powder. In order to more closely define the absolute available lysine status of these meals, a lysine bio-assay for pigs, involving semi-synthetic diets and large scale pig experimentation, is being developed.

Associated experiments have indicated that the current techniques for estimating available lysine have little application. There is a need to develop suitable techniques that are capable of accurately predicting lysine availability for pigs. The development

of a lysine bio-assay in pigs will aid these studies as it will provide reference values of absolute lysine for the different protein concentrates. These values will then be used in the development of techniques for predicting lysine availability for pigs.

Free lysine utilization: During 1976-7, the cost of protein concentrates rose considerably, as did the price of free lysine. This in turn increased the potential benefits of achieving full lysine utilization. Studies with least cost diet formulation have indicated that savings of \$14/tonne of grower pig feed could result, provided the free lysine was fully utilized.

This can be achieved by either *ad lib* or frequent feeding. Such feeding regimens ensure that the added free lysine arrives at the site of absorption and metabolism at similar times as the amino acids released from the basal diets.

Digestible energy content of feeds: Over sixty feed sources have been evaluated for digestible energy content. The results show that within many classes of feed the digestible energy content is extremely uniform. This applies particularly to different varieties of wheat, barley and sorghum. There is also close agreement between the digestible energy content of local protein concentrates and that published for overseas products.

Tables of digestible energy content of local feeds are being prepared for use as reference values by the pig industry. Their use will aid the formulation of least cost diets with computers.

Lupin evaluation: Both *Lupinus angustifolius* type Unicrop and *Lupinus albus* type WB 11 have shown considerable agronomic potential in many areas in New South Wales. Accordingly both varieties were evaluated as energy and protein sources for pigs.

Despite their high fibre content, both varieties of lupins were high sources of digestible energy for pigs (15.0 MJ of digestible energy/kg air dry feed).

Growth studies with pigs indicated that the availability of lysine in both lupin varieties was also high and similar to that of soybean meal. However, *L. albus* type WB 11 is a manganese accumulator, and this could limit its inclusion level to a maximum of 20 per cent in grower pig diets.

POULTRY

Egg Production

Restricted feeding of layers: Previous experiments have demonstrated the advantages of feed restriction during the rearing period of replacement pullets and this is now an accepted commercial practice. More recently, experiments have been conducted to test the merits of feed restriction during the laying period. Egg production was not decreased by laying period feed restriction of about 7.5 per cent in groups with two birds per standard cage, but was reduced in groups with three birds in the same size cage. Restricting food or energy intake in the laying period reduced average egg size and eliminated mortality due to heat stress.

Controlled environment for layers: Results to date have indicated an advantage in controlled compared to uncontrolled environment housing, in reduced food consumption, lower mortality, and increased egg production. For birds housed under controlled environment conditions, egg production was reduced with high density stocking.

Pesticides residues in eggs: A study has been made of the effect of a number of organophosphate grain protectant insecticides on the performance of laying hens and on egg and tissue residues. Significant depression in egg production was obtained with the following insecticides given separately in the feed at the indicated levels: dichlorvos, 40 p.p.m.; pirimphos-methyl, 100 p.p.m.; fenitrothion, 250 p.p.m.; and CGA 20168 (an unregistered insecticide), 100 p.p.m. Maldison at 100 p.p.m. did not depress production. There was a potentiation of toxic effects in some instances when two or more insecticides were combined together in the feed. This effect was noted for combination of dichlorvos (30 p.p.m.) and maldison (100 p.p.m.), and for dichlorvos (30 p.p.m.) and pirimphos-methyl (50 p.p.m.). Combination of maldison (100 p.p.m.) and pirimphos-methyl (50 p.p.m.) did not depress egg production.

Triple combinations of dichlorvos, maldison and pirimphos-methyl at the above levels, which when given separately had no effect, severely depressed egg production. These results highlight the dangers associated with multiple insecticide treatment of grains and emphasize the need to regulate on total rather than individual organophosphate levels.

Very low levels (<0.2 p.p.m.) of insecticides were recovered in the carcass fat of chickens receiving 50 to 100 p.p.m. of the insecticides. There were no residues detected in eggs. Pirimphos-methyl caused a severe depression in plasma cholinesterase.

Meat Production

Feed efficiency and body composition: A continuing study of genetic aspects of feed efficiency in broilers has shown considerable genetic variation in efficiency in birds of similar growth rate. The more efficient birds are leaner and have lower maintenance energy requirements than the less efficient birds.

Leg weakness: A study commenced in 1971 has mainly concentrated on developing a line of chickens with a high incidence of tibial dyschondroplasia (TD), a cartilage abnormality frequently associated with the occurrence of leg weakness. The mean incidence of TD in the fourth generation of the breeding programme was 83 per cent versus 9 per cent in the base population. This breeding programme continues to produce consistent circumstantial evidence for the presence of a major sex-linked gene influencing the incidence of TD.

Broiler breeder management

Because broiler breeder hens are large, produce relatively few eggs, and are predisposed to depositing carcass fat, it is necessary to restrict their food intake to achieve efficient production. Restriction during the rearing period should be fairly severe (50 to 60 per cent of *ad lib*), mild during the early laying period (90 to 94 per cent of *ad lib*), followed at about 40 weeks of age by a gradual reduction in feed allowance (about 0.5 per cent per week). This feeding pattern results in a delay in sexual maturity, an increase in peak production, an increase in total production of eggs suitable for hatching, an increase in fertility and hatchability, and a considerable increase in the economic efficiency of production compared to *ad lib* feeding.

Miscellaneous

Japanese quail control flock: Japanese quail are widely used overseas particularly for genetical research work, as they have a short generation interval with a high fecundity, and have minimal requirements for both housing facilities and feed compared to the domestic fowl. Five generations of interbreeding between founder populations have been completed, and a control flock of fifty pairs is being maintained. Stock is being supplied on a regular basis to an increasing number of Australian research and educational institutions. After this population has been genetically stabilized and its genetic parameters defined, it is intended to carry out inheritance studies involving traits of interest to the Australian poultry industry.

Metabolizable energy determination: An important component in the formulation of poultry diets is the metabolizable energy (ME) content of feed ingredients. The classical method of determining ME is total collection, where the total amount of food eaten and excreta produced are measured and analysed. Indicator methods using an indigestible marker have been developed which require only a sample of the feed and excreta. Two indicator techniques, polyethylene and chromic oxide, have been compared with total collection using diets ranging in ME. Results have shown a high correlation between the two indicator methods and total collection and high within diet repeatability for all three methods.

LIVESTOCK DISORDERS

Sheep

Blowfly strike: No change in the level of resistance has been shown in blowfly larvae (*Lucilia cuprina*) collected from animals struck after treatment with organophosphorus insecticides. Cross resistance has been shown to exist to several new groups of insecticides, and by larval implant techniques the persistence of one of them was of short duration. Field trials with compounds able to change the microclimate in the fleece continue to show control of blowfly strike at the 50–80 per cent level.

Internal parasites: Control of cestodes (tapeworms) in fat lambs showed no evidence of increased gains in production, whereas control of nematodes (roundworms) in merino ewe weaners produced increases in live weight gain and wool growth clipped. Benefits from weaner treatment for nematode control could be recorded later in life as increased lambs produced and survivors at marking.

Resistance in *Haemonchus contortus* (Barber's pole worm) and *Trichostrongylus colubriformis* (Black scour worm) to benzimidazole anthelmintics has been established and incidence studies conducted on the Northern Tablelands. Alternative anthelmintics have been tested and are effective against one or both of these species.

Nardoo poisoning: Thiaminase activity in Nardoo (*Marsilea drummondii*) has been assessed at different stages of growth, and under various seasonal conditions. Nardoo makes good growth during heavy rains and at this time thiaminase content

is high. Animals affected with polioencephalomalacia after grazing the plant respond to thiamine therapy. Animals in pen feeding trials with Nardoo of low thiaminase content have failed to show evidence of disease.

Ovine toxoplasmosis: Of forty-nine flocks surveyed, eighteen were positive to the immuno-fluorescent antibody test. Laboratory trials have induced abortion in sheep and passive transfer of oocysts occurred to incontact sheep.

Brucella ovis: Ovine brucellosis is a serious cause of infertility in sheep. The serological test method is being reviewed to enable more effective control advice to be given.

Cattle

Internal parasites: Management methods for control of *Ostertagiosis* in dairy calves have indicated that a treatment with broad spectrum anthelmintics in March reduced pasture contamination in autumn and winter, resulting in better growth rates. In beef herds, spelling of pasture or grazing with adult cows or sheep over winter reduced the availability of larvae in spring, but breakdowns occurred in the following February/March.

Fascioliasis: Growth rates were not significantly changed when grazing cattle artificially infected with 1 200 metacercariae were compared with cattle grazing similar pasture and kept free of liver fluke.

Retinal coloboma: This condition is recorded as a genetic defect of Charolais cattle. The incidence recorded was 6.4 per cent of animals in 7 per cent of herds with the highest incidence in one herd being 23.5 per cent in 17 head at slaughter.

Vibriosis: The causal organism, *Campylobacter fetus*, can cause serious herd infertility problems. It has been recovered from three of ninety-four bulls in a survey on the Northern Tablelands and Slopes.

Brucella abortus: Confirmation of infection is being obtained by recovery of organisms from tissues of animals with positive serological titres.

Hydrancephaly in calves: A serological survey from thirty-five properties on the New England Tablelands indicated that the Tablelands are free of these arbo-viruses. Occasionally the vector, *Culicoides brevitarsus*, can be blown into the area leading to infection of susceptible cattle.

Pigs

Erysipelothrix rhusiopathiae: Swine erysipelas is a major cause of arthritis in pigs, which necessitates condemnation at slaughter. Serological agglutination tests are being used in an endeavour to differentiate serotypes.

Shaky pig disease: Little is known of the aetiology of this disease (Chorea Myoclonia congenita), which has a world wide distribution. Confirmation has been obtained that it can be transmitted via pregnant sows and can be passaged in tissue culture. Low dilutions of virus can artificially produce the disease.

Poultry

Marek's disease: Vaccines other than the Herpes Virus of Turkeys have been tested for viability. Attenuated Marek's Disease Virus (MDV) and apathogenic MDV vaccines have shown an ability to reduce the incidence of Marek's disease.

Other diseases

Mycoplasmosis in goats: *Mycoplasma mycoides* var *mycoides* can cause serious disease in goats and is closely related to bovine pleuropneumonia. Methods for isolating the causal agent from tissues are showing promise. Samples from joints, milk and nasopharynx in a suspected chronic donor have failed to reveal organisms.

Toxic blue green algae: Poisoning due to *Anacystis circinalis* was diagnosed in New South Wales in 1966. In 1973, toxicity in bees due to a related species, *Anabaena circinalis*, was reported; and in 1975 the same species was responsible for toxicity in sheep and poultry.

Immunity: Enteric diseases in neonatal animals are serious causes of economic loss. Vaccination may be more economic than control therapy. Oral immunization of foetal animals via the amniotic fluid 14 days before birth has shown an increase in immunoglobulin and specific antibody in serum at birth.

CATTLE TICK CONTROL

Acaricide Application

Dip management: Chlordimeform was replaced in 800 dips by 'Taktic', the tradename for a wettable powder whose active ingredient is amitraz. It requires stabilizing at pH > 10 by adding lime.

Trials were conducted to manage dips efficiently and economically. Adequate stirring required the use of a long handled shovel to lift the sediment, followed by dipping twenty cattle or pulling a mechanical stirrer twenty times at the rate of ten seconds per pull.

The chemicals in the wash of well used dips (through which at least 1 500 cattle had passed) did not settle out within an hour of stirring. Furthermore there was no loss of chemicals when such dips were stirred and scooped 10 minutes later to remove undesirable heavy sediment.

Chemical analysis: To satisfy the output required to monitor 800 dips charged with the new acaricide 'Taktic' four methods for determining the active ingredient, amitraz, were developed. One, based on US spectroscopy, was rejected because interference caused inaccuracy. An IR and a GC method, both using petroleum ether extraction, were acceptable. The best, because of simplicity, was a GC acetone dilution method: 120 samples per day could be analysed by 3 technicians using one machine, with an accuracy of ± 2.5 per cent.

A method was developed to determine total residue of amitraz and its metabolites in milk, butter and cattle fat. It is based on conversion to the metabolite 2,4-xylidine, and uses acid hydrolysis with evaluation by GC. Satisfactory recoveries of 80 per cent were achieved in milk and butter fortified to 0.1 and 0.4 p.p.m. respectively.

Pesticide Residues

Storherr sweep co-distillation technique: Modifications were effected to make it simpler, more efficient and faster. It was found that solvent introduction into the distillation tube was unnecessary, and a flow rate of 600 ml/min and an operating temperature of 230° C were advisable for analysis of organo-chlorine and -phosphorus compounds. Two new condensers were made and a simple method of packing the distillation tube was developed.

DDT and dieldrin: Residues were monitored in the fat of steers by biopsy sampling, and in the butterfat of cows, both fed a chemical fortified grain diet at the rate of 6, 36 and 216 mg DDT/day and 36 mg dieldrin/day.

Total DDT residues exceeded the maximum residue limit (MRL) of 5 mg/kg in body fat at the highest rate of feeding. The MRL of 1.25 mg/kg for butterfat was exceeded at the intermediate and highest rate.

DDD was the major metabolite from DDT in the body and butterfat of these grain-fed animals: it formed 80–85 per cent of the total DDT residue in those fed the highest rate.

Preliminary estimates of half-life were 12, 5 and 15 weeks for DDT, DDD and dieldrin respectively in body fat; and 7, 2.5, 6 and 5 weeks for DDT, DDD, DDE and dieldrin in butterfat. A half-life for DDE in body fat could not be determined because it did not decline during the observation period of 15 weeks.

MASTITIS

Post Milking Teat Sanitation

An experiment was conducted to determine if 0.1 per cent iodine teat dip was as effective as a 0.5 per cent iodine dip in reducing the number of bacterial infections following regular challenge with *Strep. dysgalactiae*. There was no significant difference between the number of new quarter infections in teats dipped with 0.1 per cent, 0.5 per cent, or the undipped control group.

It is suggested that *Strep. dysgalactiae* may not colonize the teat canal prior to invading the udder and is therefore not controlled by post milking teat sanitation. This experiment will be repeated using *Staph. aureus* as the challenge organism.

Cell Count and Practices Survey

A survey of all dairy farms was conducted in the Bowral–Moss Vale area. Although Bowral and Moss Vale factories draw their supplies from overlapping areas in the same geographic area, they have been consistently different in average bulk milk cell count. Bowral is consistently the best factory in the State, while Moss Vale is about average. The respective geometric means for the six months prior to the survey were 377 000 and 577 000 cells per ml.

The survey of 115 farmers was conducted by personal interview and by static milking machine test to examine factors likely to influence cell count. Only 42 per cent of farmers surveyed currently used a post milking spray or dip but 18 per cent had ceased the practice in the past 2 years. Dry cow treatment of all cows was practised by 35 per cent of farmers, while only 21 per cent had not used this form of treatment. However, only 22 per cent used both teat dipping and dry cow therapy on all cows.

The following factors were associated with significantly lower cell counts at both factories analysed on a within factory basis: teat dipping, no udder drying, milking phase of 30–40 per cent. Washing the udder with water and soap, dry cow treatment and abrupt cessation of lactation all had no significant effect alone, but had significant interaction with the application of teat dipping. There were significantly lower cell counts when certain combinations of practices were used. However, none of the sixty-five factors and attitudes surveyed explain the continuing difference between the two factories.

Improved Electronic Diagnosis of Mastitis

Using a Coulter TA volume analyzer in conjunction with a Coulter Counter, the accuracy of detecting infected quarters was improved when compared to somatic cell count alone. With quarter milk samples, the number of false positives was reduced from 40 per cent to 26 per cent, and false negatives increased from 0 to 2 per cent. For composite udder milk samples, the differences were similar, 35 per cent to 19 per cent, and 3 per cent to 5 per cent respectively. It is suggested that cell volume should be used in conjunction with all cell counting programmes.

Teat Dipping and Milk Iodine Levels

Three groups of cows were allocated the following treatments for a period of 6 months: (1) two teats per cow dipped in 0.1 per cent iodine; (2) two teats per cow dipped in 0.5 per cent iodine; (3) no teats per cow dipped.

Teats dipped in 0.5 per cent iodine had milk containing 411 ugI/1 of iodine, while milk from these dipped in 0.1 per cent iodine had 230 ugI/1. The undipped teats adjacent to those dipped in 0.5 per cent iodine, had milk containing 242 ugI/1, while those undipped and adjacent to 0.1 per cent iodine dipped teats had milk with 190 ugI/1. Cows in which no teats were dipped had milk containing 150 ugI/1, which was significantly lower than the other four groups.

Because milk from undipped teats of an udder which has had two teats dipped has significantly higher levels of iodine than milk from udders to which no iodine has been applied, it appears that iodine is absorbed through the teat skin and systematically redistributed.

GOATS

Weed Control

A preliminary experiment on a serrated tussock *Nassella trichotoma* site at Mt David indicated a 90 per cent reduction in seed production from serrated tussock. Goats maintained weight whilst grazing on this and other pasture species. As a result of this observation, an experiment will be conducted which will include various stocking rate levels and animal mixes.

In another experiment on a blackberry *Rubus fruticosus* L. agg. site, bush goats defoliated all accessible blackberry bushes and thus prevented flowering and seed dispersal. Mechanical destruction of bushes was evident to such an extent that the site can now be restocked with sheep. Observations are continuing on the complementary use of herbicides to effect control of crowns.

RESEARCH IN BIOLOGY AND CHEMISTRY

NOXIOUS ANIMALS

Rabbits

Rabbit Control in the Western Division: Research in the Western Division has been investigating optimum control techniques, the most important warren types to destroy, and optimum environmental conditions for control. Findings have indicated that ripping limestone warrens during dry periods is the best control method. During non-drought periods, land systems, not warren types, become more relevant to control. One shot oat poisoning with 1080 was found to have little value.

Evaluation of rabbit free areas: Studies have determined that rabbits are very scarce in all rabbit free areas, regardless of the approach by Pastures Protection Boards. However, expansion into new rabbit free area programmes is not occurring, apparently because Boards are unable or unwilling to supply the additional manpower necessary to monitor these areas.

Rabbit invasion trial: A new project located at Cowra Agricultural Research Station will study the effect pasture condition has on rabbits' ability to initially invade that pasture and, after invasion, to increase in numbers.

Feral Pigs

Biology and control: A new project is evaluating the economic impact of feral pigs on agriculture by studying pig predation on lambs and damage to crops. The effectiveness of current control techniques will be studied by comparing various poison baits and traps in different environments. At the same time methods of population estimation will be evaluated.

Rodents

Ecology and control of the house mouse: Research based at Glenfield Veterinary Research Station has commenced to examine the effects of nutrition and nesting sites on the rate of population increase. Studies on anticoagulant and acute poisons for control are continuing.

Vertebrate Pests

Exotic Disease: A new project has been undertaken to provide appendices for the feral animal control part of the Exotic Disease Contingency Plans. Control techniques for the relevant animals will be described and tested for effectiveness.

Survey of the Eastern and Central Division: A new project will survey the distribution and abundance of vertebrate pests in the eastern and central parts of New South Wales. The information will be used to aid rabbit and pig research and to supplement the exotic disease project.

SYSTEMATICS

Systematic research provides a firm base for the identification, naming and scientific study of plants and animals. It is of immediate importance in relation to the control of various weedy and noxious plants, plant diseases and animal pests. In addition it provides detailed and accurate information on various plant and animal groups and new data of significance to biogeography, ecology and evolution.

Vascular plant systematics

The research work of the National Herbarium utilizes a broad range of taxonomic and biosystematic approaches and covers various plant groups.

Flora of New South Wales: The treatment of the family Plantaginaceae was published and manuscripts of the genera *Tetralix*, *Crotalaria* and *Ludwigia* and of the family Polygalaceae completed. Work progressed on other genera of the Papilionaceae and also on *Epilobium* and *Cyperus*.

Revisions and new taxa: Revisions of genera and families on an Australia-wide basis forms a considerable part of the research work, together with descriptions of new taxa. Studies of Restionaceae, Casuarinaceae, *Acacia*, *Craspedia*, *Glycine*, *Grevillea*, *Eriachne*, *Leptospermum*, *Leucopogon*, *Livistona*, *Xanthium*, *Zieria* and various genera of the Orchidaceae are continuing; work on *Galium* has been completed.

Information on some new species of *Eucalyptus*, *Acacia* and *Olearia* was published and descriptions of new species of *Juncus* and *Stylidium* prepared. The new name *Chionhebe* was published for the genus formerly known as *Pygmea*. Studies in Pteridophyta progressed; the description of a new fern genus, *Coveniella*, was completed.

Floristic studies: Compilation of the *Census of the Dicotyledons of NSW* was completed and the data sheets are being checked; work on the checklist of subalpine plants of the Kosciusko region is continuing as is the checking and updating of the census of species cultivated in the Royal Botanic Gardens. *A Handbook of the Flora of Lord Howe Island* is in preparation; the plant census and distribution maps are complete.

Anatomical and Morphological studies: Detailed studies of anatomy are contributing to revisional work in *Cyperus*, *Eleocharis*, *Juncus* and the Restionaceae. Work on the ultrastructure and anatomy of various groups of grasses and sedges continued and some of the results have been submitted for publication. Studies of pollen and seed surface morphology using scanning electron microscopy as well as light microscopy have provided some useful data on various groups in the Epacridaceae, Proteaceae, Restionaceae and Rutaceae. Comparative studies of inflorescence structures throughout the Myrtaceae continued as the first stage of a consideration of generic relationships and classification.

Other projects: Analysis of the floral biology and pollination mechanisms of various genera in the tribe Boronieae continued in the course of biosystematic and evolutionary studies in the family Rutaceae. Historical, biographical and bibliographical

work on early plant collections continued, in particular with regard to the Banks and Solander collections held in New South Wales. Partly through the collaboration of other researchers, a considerable amount of cytological work was undertaken in *Zieria* and various groups of ferns, while chemical analyses of *Zieria*, *Acacia* and certain fern groups continued.

Fungal Systematics

The control of many plant diseases rests on the accurate identification of fungal pathogens. Research at the Biological and Chemical Research Institute is concerned with the clarification of fungal taxonomic problems and also with the investigation of many aspects of fungal biology and pathology.

Many different groups of fungi were investigated. The identity of several of the fungi associated with greasy spot of citrus overseas was ascertained by study of Asian, European and American material; the distinctiveness of the Australian greasy spot organism was established. Work continued on *Gaeumannomyces*, related Ascomycete genera associated with cereal take-all, and a number of plant parasitic fungi including clover rusts, ryegrass smut, and gall smut of rushes and sedges. Information was published on the rusts of *Oxalis* and *Mahonia* in Australia and a world-wide revision of the *Aristida* smut fungi completed. *Angophora* canker was investigated further and a study of the taxonomy and pathology of wattle rusts initiated. A short note on the *Dothistroma* needle blight of *Pinus* spp. was published.

The Biological Branch Herbarium (DAR) continued to build up its collections (now over 43 000 specimens), and some valuable material was received on exchange from overseas herbaria. Work continued on the compilation of a check list of plant diseases in New South Wales; a survey of plant diseases on Norfolk Island was carried out. The 26 000 records now on computer tape and print-outs of information were supplied to a number of Australian and overseas institutions.

Insect Systematics

Further studies were undertaken on the beneficial Phytoseiid mites of apples and citrus and a number of new species were recorded from other plants. Their significance as biological control agents is being investigated. Taxonomic work was initiated on flies of the family Sciaridae and on the armoured scale insects of the family Diaspididae; both groups cause considerable damage to agricultural crops.

A large part of the reference collection was rearranged into taxonomic order and over 4 600 insect specimens and 2 200 slide specimens of mites incorporated.

Nematode Systematics

Studies continued into *Heterodera avenae* (cereal cyst nematode) and another species, *H. trifolii*, found on white clover in the Sydney area. Stem nematode of lucerne was detected in the upper Hunter valley and near Tamworth; several nematode species associated with grapevines in the Murrumbidgee Irrigation Areas were investigated. There were 19 species of nematodes identified from a survey of soils in rice growing areas of the Murrumbidgee but none were known pests of rice. Over 100 accessions were added to the nematode reference collection.

PLANT ECOLOGY

Current ecological investigations consist of broad-scale surveys and mapping of the vegetation of New South Wales and Lord Howe Island, together with more detailed studies of natural vegetation patterns and of regeneration patterns after burning and mining.

Vegetation Studies

Survey and mapping: Mapping of the original vegetation of the Sydney–Wollongong area continued; vegetation description and mapping of the Wianamatta Shale areas was largely completed and analysis of the site data undertaken. Mapping of the northwest New South Wales area progressed well; 10 of the 16 component sheets have been compiled and data from 110 sites collected for computer analysis.

A vegetation map of Lord Howe Island was drawn for publication and work continued on the memoir to accompany the map.

Regeneration studies: Plant frequency records continued to be collected at Mosman and Ivanhoe where vegetation is regenerating following burning and mining respectively. The data have been analysed by computer.

Pattern analysis: The study of vegetation patterns in certain areas of the northern Budawang Range was completed and the data analysed.

Algal Ecology

Toxic algae: A study of the factors associated with the blooming of toxic algae in Burrinjuck Dam has been completed. A series of experiments aimed at preventing or reducing the development of blooms of toxic algae have continued using iron alum. The results of the studies are ready for publication.

Pollution: Studies of the effects of pollution on marine algae continued at Ulladulla, Jervis Bay and Botany Bay with regular sampling of algal populations being undertaken.

PESTICIDE CHEMISTRY

Pesticide Contamination of the Namoi Cotton Environment

A pilot study was conducted by Biological and Chemical Research Institute, Rydalmere (BCRI) in 1976 to assess the contamination of grazing pastures adjacent to cottonfields from aerial drift of cotton sprays. The study also evaluated sampling and analytical procedures for a larger study in 1977. The situations investigated were: (a) pastures adjacent to cottonfields on the perimeter of the cotton area; (b) pastures "surrounded" by cotton within the cotton area; (c) Travelling Stock Routes (T.S.R.) adjacent to the cotton area; (d) pastures remote from the cotton area (controls).

The sampling and analytical procedures developed for pasture and soil were adequate to indicate levels and trends in pesticide contamination. Duplicate samplings by different personnel produced relatively small variations in residue levels. Hence single samples in a series should adequately reflect contamination trends.

Pasture was a more sensitive indicator of contamination than soil, presumably due to the large dilution of surface soil residues (possibly ten-fold) when 5 cm deep cores were taken. Since pasture varied considerably in moisture content, residues should be expressed on a dry weight basis for comparative purposes.

The analytical procedure discriminated between the various forms of DDT residues, but total DDT more clearly indicated contamination trends. TLC was used in addition to GLC to discriminate between DDT and Toxaphene (commonly applied with DDT), but Toxaphene was not detected in pasture or soil.

Grazing areas remote (5–30 km) from the cotton area were virtually uncontaminated with DDT (pasture < 0.01–0.03, soil < 0.01 ($\mu\text{g/g d.w.}$)), but in all situations adjacent to cotton properties, significant contamination (up to 44 $\mu\text{g/g}$ in pasture; up to 5 $\mu\text{g/g}$ in soil) was detected. On T.S.R., pasture contained up to 9 $\mu\text{g/g}$ and soil up to 1.5 $\mu\text{g/g}$.

Pasture residues occurred only as pp'-DDT, but in soil, DDT metabolites were also detected. pp'-DDT and pp'-DDE were the major contaminants on grazing land, which raises residue implications for grazing stock.

Data from properties on the perimeter of the cotton area suggested that contamination may extend well beyond the 800 m limit investigated. There was evidence that pasture contamination could be greater at 200–400 m than at 0–100 m from cotton crops, although soil contamination generally declined steadily as distance increased. The contamination of T.S.R. adjacent to cotton-fields reached a hazard level for stock passing through the cotton area.

Organophosphorus Pesticides in Grain Dust and Poultry

Several trials were conducted at Seven Hills Poultry Research Station and BCRI to investigate reports by poultry farmers of production losses from feeds containing grain dusts contaminated with organophosphate insecticides.

The most toxic compound found in grain dust, dichlorvos, was relatively non-persistent; 60–97 per cent was lost from treated feed stored for 1–3 weeks in bins, an open feeding trough and a "sealed" plastic container. However, dichlorvos, maldison and fenitrothion residues were not effectively reduced when feed was pelletized under conditions of low temperature (ca 70° C) and added moisture (ca 1 per cent).

Diets nominally containing 40–80 $\mu\text{g/g}$ dichlorvos depressed egg production and feed consumption over four weeks, but negligible residues (< 0.1 $\mu\text{g/g}$) were produced in bodyfat. Lower levels of dichlorvos (15–30 $\mu\text{g/g}$), in combination with maldison (50–100 $\mu\text{g/g}$) and pirimiphos-methyl (50 $\mu\text{g/g}$), caused similar effects in poultry fed for 4 weeks. Traces of pirimiphos-methyl (0.08–0.17 $\mu\text{g/g}$) and maldison (0.04–0.07 $\mu\text{g/g}$), but no dichlorvos, were detected in body tissues.

Dichlorvos, maldison and pirimiphos-methyl, alone or in combination, adversely affected blood cholinesterase levels in poultry. The pirimiphos-methyl treatments produced severe inhibiting effects (ca 90 per cent). The rate of recovery following the combined treatments appeared to be retarded, possibly indicating toxic potentiation effects.

Residues in Fruit

Bromide in oranges: Valencia oranges were investigated for bromide residues at BCRI following experimental ethylene dibromide (EDB) fumigations at Gosford HPHL. Residues were affected by the EDB dose, but twenty-four hours' aeration at 20° C following fumigation reduced EDB in fruit by up to 67 per cent. During 14 days subsequent storage at 6° C, excessive EDB levels declined to below the current 0.5 µg/g Australian limit. During storage, inorganic bromide (B_π) residues increased and persisted in the fruit, although levels were always within Australian and USDA limits. After twenty-eight days' storage, only B_π residues were detected, 60 per cent in the peel and 40 per cent in the pulp. Results confirmed previous research with Washington Navels that ambient aeration and low temperature storage are effective in reducing excessive EDB levels in oranges.

DDT and omethoate in bananas: A Departmental trial at the Tropical Fruit Research Station, Alstonville, investigated the effect of DDT and omethoate treatments for the control of corky scab. Bananas were analysed for DDT and omethoate residues at BCRI.

Immature fruit were harvested 2.5–3 months after plants received 5–6 throat sprays of DDT (500 ml of 0.1 per cent) or 6 throat sprays of omethoate (500 ml of 0.1 per cent). Mature fruit were harvested 4–5 months after a single DDT application (50–75 ml of 0.1 per cent) at bunch emergence, or 1–3 throat sprays of DDT or 3–4 throat sprays of omethoate.

Residues could not be detected in any treatment irrespective of the number of applications or the withholding period.

Benzimidazole Fungicides

Bananas: A test procedure was developed at BCRI to assess benzimidazole deposits on bananas dipped for disease control. Routine field testing has shown that poor deposition efficiency of many dips is linked with disease incidence. This problem is being studied in co-operation with the Banana Growers Federation of N.S.W. Results of a laboratory study suggest that formulation characteristics and the over-use of wetters by growers are important factors.

Mushrooms: Laboratory and field studies by BCRI Rydalmere investigated reports of inadequate disease control from recommended applications of benzimidazoles under commercial conditions. The results indicated that benzimidazoles can be adsorbed strongly onto highly organic peat materials, leaving inadequate concentrations (equivalent to less than 0.1 µg/g) available for disease control. Techniques for increasing the availability of fungicide without reducing yield are being studied.

Methodology

2-aminobutane in fruit dips: A rapid analytical method for registration purposes was developed at BCRI to estimate dip concentration and stripping rates of 2-aminobutane (2-AB) in postharvest citrus dips. The method is based on the conversion of 2-AB to a thio-carbamate compound, which is complexed with copper to form a yellow chloroform-extractable complex measured at 430 nm. The method is routinely used by Departmental horticulturists for citrus dips and should be applicable to banana and other postharvest fruit dips.

WATER QUALITY

Mineral Contamination

For the second consecutive year, four rivers and eight drainage sites in the Namoi Cotton Area were sampled weekly during the irrigation season.

As with last year, most of the drainage sites were excessively contaminated. The highest level of nitrate/nitrogen (8.9 mg/l) was found in drainage from a large cotton farm, where nitrogen was applied at rates of 100–150 Kg N/ha/annum. The highest level of phosphate/phosphorus (0.138 mg/l) was in a creek draining a sheep grazing area.

The part of the Namoi River influenced by such a drainage contains on average 0.47 mg/l nitrate/nitrogen, 0.24 ammonium nitrogen and .063 mg/l phosphate /phosphorus. These levels were fewfold higher than the upstream control site and high enough to cause eutrophication problem.

Lake Tandou

The project aims to monitor the effect of water salinity and irrigation practice on soil salinity and structure at Lake Tandou, with a view to preventing deterioration in soil fertility and structure.

The trial was established on an area of 4 ha. Soil samples were collected to about 105 cm depth before the irrigation season. Quality of irrigation water and drainage water is being monitored and yield and composition of crop will be evaluated. Thus a salt balance for the area can be obtained.

PLANT NUTRITION

Acid Soils Nutrient Problems

A series of glasshouse trials were conducted on nine soils high in exchangeable aluminium from widely separated areas throughout the State. Lucerne responded to high rates of both phosphorus and lime. Aluminium and/or manganese toxicities were encountered. Straight line relationships were found between soil aluminium and pH measured in calcium chloride. Seven of the soils from widely differing origins showed similar basic p A1/pH relationships, but the other two behaved differently. Investigations are proceeding to determine the nature of these different behaviours.

Field trials on the central and southern tablelands have shown big responses to high lime and phosphorus treatments. Lime reduced soil aluminium more than phosphorus, while only lime reduced plant aluminium. Seasonal differences markedly affected lime responses where manganese was toxic. Several sites gave good lime responses in the wet season of 1976 due to periods of water-logging, but not in 1977.

Absorption by Fruit Trees of Foliar Applied Nutrients

Laboratory investigations have shown that a high concentration of wax in the cuticle and around the guard cells of leaves of stone fruit trees was related to poor entry of macro quantities of nutrients into the leaves. Field evaluation trials with urea sprays and surfactants were conducted to assess the laboratory findings. Leaf sprays were timed for the October-November period when the wax barrier was thinnest.

Fertilizer nitrogen for prune trees was applied on the ground or to the foliage as sprays. For the same rates of nitrogen application, each method was equally effective in raising leaf nitrogen concentration. Spring application had a greater effect on leaf nitrogen in summer than autumn treatments. The best treatment was 400 g N per tree applied on the ground in autumn followed by 300 g N as a foliar urea spray in spring.

The non-ionic organosilicone surfactant L-77 was not superior in the field trial to the conventional agricultural non-ionic surfactant X-77 despite better physical and physiological properties shown in laboratory tests.

Apple Leaf Analysis

The nutrient status of Granny Smith and Delicious apple varieties from seventy-five orchards in Armidale, Batlow and Orange districts, were assessed by leaf analysis. Results were compared with fertilizer programmes and crop yields. Mean N, P and K levels were highest from the Orange district while calcium and magnesium were highest for the Batlow district. Zinc was found to be below the set critical figure in most orchards from all three districts. This suggested that either incipient zinc deficiency was widespread, or that the standard was set too high. A review of apple leaf standards is a principal aim of the study.

Zinc Deficiency—Plant and Soil Analysis and Residual Effects

Analysis of maize leaves at tasselling stage were related to zinc application and yield response. Analysis of plants in the seedling stage has proven unreliable and erratic. It is important to get a diagnostic index which can be applied very early in the life of the crop or even before sowing. Soil and plant seedling analyses are being examined.

Analyses of dissected tissues have shown high accumulation of zinc in certain tissues out of proportion with zinc supply. The effect appears variable and time dependent. Work is proceeding to understand where and when zinc accumulates in seedling tissues. In another study, zinc stored in maize seed was found to affect seedling growth.

A long term trial at Breeza tested a range of soil zinc treatments. Four initial rates of zinc were each followed by three follow-up rates, so that, in all, sixteen levels of zinc were used. Soils were analyzed for zinc using the Lindsay and Norvel procedure.

Soil zinc test was related linearly to rate of zinc application where no annual dressings were made. Higher parallel curves resulted where zinc was applied annually.

Soil tests indicated a significant fall in extractable zinc during the five years since the trial commenced. However, yield was still maintained at 80 per cent of maximum levels by low application rates of zinc (6.6 kg Zn/ha). A high level of response (100 per cent) over the nil treatment was maintained in the fifth year.

Biochemical Measures of Nutrient Activity

Assessment of plant nutrient status by total chemical analysis of the plant can be misleading where a significant fraction of an element in a plant is physiologically inactive. A study aims to develop biochemical assays for nutritional status of zinc in maize plants. Methods were developed to assay three enzymes chosen because of their physiological relationship to zinc in the plant. Aldolase is activated by zinc, ribonuclease is inhibited by zinc and carbonic anhydrase contains zinc.

In vitro studies of the enzymes extracted from maize revealed that ribonuclease was inhibited by high zinc concentration, but the adolase enzyme was not activated by zinc. Assays of maize tissues were made in a factorial zinc/phosphorus pot trial. These showed that both ribonuclease and aldolase were insensitive to zinc treatments, but carbonic anhydrase activity was related to zinc application, growth response and symptoms.

Nutrient Status of Potato Crops and Soils

Glasshouse trials studied poor growth of oats sown after potatoes in the Robertson district. These showed that oats responded to magnesium, calcium and increased soil pH. However, magnesium deficiency was primarily to blame for poor growth of oats in former potato rows. Potassium depressed yield in the absence of magnesium; this indicated that high application of potassium in potato fertilizer bands was the likely cause of banded yellowing and stunting seen in oat crops in the district. Oats and ryegrass, two species grown in rotation with potatoes, were more responsive to magnesium treatment than potatoes.

Leaf analysis surveys of potato crops were made in the Robertson and Dorrigo districts. Leaf nitrogen levels were satisfactory in all crops, but four crops were low in phosphorus and four others low in potassium. Magnesium was low in only one crop, but leaf manganese was high in many crops. Soil pH's (1:2 water) ranged from 5.0 to 4.5, and aluminium rose to high levels as pH dropped below 5.0.

SOIL BACTERIOLOGY

Bacterial Stimulation of Plant Growth

A research programme continues the study of mechanisms involved in the stimulation of plant growth after inoculating seed with various strains of bacterium, *Bacillus* spp. Techniques developed for specifically tracing these organisms use highly sensitive fluorescent antibody labelling and incident light fluorescent microscopy. Observational studies of *Bacillus* spp. on plant roots and in soil employ these techniques as well as scanning electron microscopy.

Soil Ethylene as a Regulator of Microbial Activity

Ethylene, a critical regulator of soil microbial activity, plays a key part in turnover of organic matter, recycling of plant nutrients, and the biological control of soil-borne plant pathogens. Research this year has identified a fat-soluble precursor of ethylene with large molecular weight, which originates from plant leaves. The latest research shows that soil ethylene is not directly produced by micro-organisms in soil but is chemical in origin. Micro-organisms are responsible only for creating the specific environmental conditions required for the chemical reaction to occur. Further research aims to determine the chemical structure of the precursor so that it may be artificially synthesized and possibly used as an amendment to agricultural soils.

Non-symbiotic Nitrogen Fixation

A survey of soils under sixty different grasses from twelve widespread sites in New South Wales has shown that nitrogen fixation occurred substantially in 70 per cent of the samples. The medium used was partially selective for the important nitrogen fixing organism, *Azospirillum braziliensis*, but its presence has not been confirmed.

Biological and Ecological Control of Phytophthora Root Rot

Some red basaltic soils from certain avocado groves and natural rainforests were found to suppress *Phytophthora* Root Rot. Suppressive soils had high organic matter, high cation exchange capacity, high nitrogen levels with a balance between NH_4^+ and NO_3^- ions, high soil ethylene levels, and a large and diversified microbial population. The role of micro-organisms in suppressing root rot was shown, but the suppression could not be transferred to other soils. A long-term avocado management trial has been established to investigate the role of these parameters in controlling *Phytophthora* Root Rot. Recent research shows that humic fractions of the soil, especially calcium humate, play an important role in suppressing *Phytophthora*.

Legume Nodulation and Fixation

Rhizobium: *Rhizobium* strains isolated from naturalized white clover plants on the far north coast have shown greater tolerance to high temperature than the current commercial strain. A selection of these isolates is being compared in the field with the commercial strain for nitrogen fixing ability and persistence in the soil.

In *Rhizobium* strain tests, no strain was found superior to the current commercial one for peas, and the commercial strain for soybean was effective on a range of soybean varieties and breeding lines.

Inoculation: Yields of peas and soybeans were increased by seed inoculation in field trials on soils deficient in their respective *Rhizobium* strains. Inorganic nitrogen fertilizer did not increase the yield of inoculated soybeans.

When pea or soybean seed was treated with the fungicide Captan,[®] nodulation was better when the seed and inoculant were kept separate. This was achieved by applying the inoculant on lime pelleted sand or suspended in water.

Further investigation of white clover seed treated by the commercial process Prillcote[®] confirmed that *Rhizobium* numbers are variable and frequently unsatisfactory. Also, rhizobia do not survive well on the seed unless held in cool storage.

Various adhesives are being tried with filter mud, a waste product from sugar mills, for the preparation of pellets for use as solid inoculants.

Moisture stress: Nitrogen fixation by nodulated subterranean clover plants declined after 2 days' wilting and ceased after wilting for 4 days. It recommenced after watering and recovery was complete after 5 days. Little structural damage was found in the nodules of plants wilted for 4 days but starch deposits were depleted. These were replaced after watering.

ELECTRON MICROSCOPY

Citrus Dieback

Further studies have been made on this disease at the Biological and Chemical Research Institute. A detailed study compared an uninoculated control plant with a plant infected with the disease. A study of the leaves of the two plants, produced no evidence of any pathogen other than some cells containing what appeared to be rod-like virus particles. An examination of the roots of the two plants revealed that those of the infected plant were in an advanced state of breakdown compared to the control. The roots from diseased plants contained many cells which appeared to be filled with rod-shaped particles, but this phenomenon was absent in the roots of uninoculated control plants. Roots from both plants also contained fungal tissue and walled prokaryotic organisms; these were prevalent in diseased plants, but only rarely seen in control plant roots. The identification of any causal organism or ultrastructural features characteristic of this disease has been unsuccessful.

Plant Virus—Host Relationships

An investigation has been carried out on the potato virus complex occurring in potato crops along the Murray River area in New South Wales. This disease has not been completely diagnosed or characterized, but at least one of the viruses involved is Potato Virus X. This virus is the type member of the Potexvirus group, which also includes Cymbidium mosaic virus, white clover mosaic virus, Potato aucuba mosaic and clover yellow mosaic. These viruses are difficult to identify rapidly by electron microscopy as they all have a similar size, and there is no detailed information on the ultrastructural effects on cells except for Potato Virus X and clover yellow mosaic; the latter virus has not yet been recorded in Australia. A programme is underway at the BCRI to collect isolates of each of these viruses to compare them ultrastructurally. Then a rapid diagnostic method may be established.

[®] Registered trade names.

SOILS

Soil Chemistry

Phosphorus: Knowledge of the fundamental physico-chemical factors that control availability of phosphorus in pasture soils should lead to a better understanding of phosphate fertility.

Work at the Agricultural Research Centre at Tamworth aims at better definition of the adsorption-desorption process and development of more meaningful soil tests.

Preliminary studies indicated that the Olsen (bi-carbonate) test should be superior to others; it extracts phosphorus only from the labile pool, and the amount extracted is inversely related to the buffering capacity of the soil.

In a glasshouse experiment using 30 soils, the superiority of the Olsen test was confirmed when it correlated better with phosphorus uptake by white clover than did the Bray P-1 method. There was no relation between uptake and the Mehlich test which is used in the Wagga region.

Field and laboratory work continued on the twenty pasture fertilizer trials on the central tablelands. The project aims to find critical phosphorus levels in the major soil types above which there is no economic response to superphosphate applications.

Climate has a significant effect on soil phosphorus levels; they drop substantially after a period of wet or waterlogged conditions but build up during long drought periods.

Implications are that farmers should consider applying superphosphate in the spring rather than the traditional autumn to avoid loss of phosphorus during wet winters. Further, they should defer topdressing until some months after the end of a drought.

Analysis of wheat grain has shown that certain cultivars contain up to 50 per cent less phosphorus than commercial cultivars. If this finding is confirmed in field trials, use of low phosphorus wheats could mean lower fertilizer costs in the future.

Potassium: The amount of exchangeable potassium in a soil is not always a good estimate of a soil's ability to supply potassium to the plant. The reason could be that no account is taken of potassium in the non-exchangeable form. Knowledge of the source of both forms should lead to a better understanding of the mechanisms in soils which supply potassium.

At the Biological and Chemical Research Institute, Rydalmere, a study, using a collection of soils from a previous potassium survey, is trying to relate soil mineralogy to form of potassium.

Lime: Increasing soil acidity is thought to be a major cause of problems associated with unthrifty pasture production on some tableland and coastal soils.

Poor establishment and persistence of lucerne and thinning out of subterranean clover pastures are symptoms of substantial declines in carrying capacity and a less productive cropping phase in the rotation.

The soils affected usually have a light textured surface overlying a deep A₂ horizon, with a much heavier textured B horizon or subsoil beneath. They have an acid reaction (pH 4.3–5.3), are low in bases (exchange capacity 2–3 milli-equivalents per 100 gm), and have high levels of available aluminium and/or manganese.

The main problem areas are in the southern half of the Wagga agricultural region around Albury, parts of the southern and central tablelands, and parts of the south and north coast regions.

Lime applied at rates as low as 1 000 kg/ha has significantly improved dry matter production and nodulation of subterranean clover in the southern region. A similar rate of lime was spread and then incorporated into the surface soil 3 months before sowing. This resulted in satisfactory establishment of lucerne in trials in the Blayney and Meadowflat districts in the central tablelands.

SOIL PHYSICS

Structurally unstable soils: Rapid wetting of a dry unstable soil, as in ponding, results in low infiltration and percolation rates. In contrast, wetting of the same dry soil at a restricted rate, as in trickle irrigation, results in much higher rates.

These observations illustrate an important principle in the irrigation of structurally unstable soils—if the topsoil is moist before surface irrigation, or a dry soil is wet slowly (trickle irrigation), then soil aggregates break down less and infiltration rates are higher.

Crusting soils: Surface crusting of light textured red soils and low infiltration rates cause problems in plant establishment and irrigation technique for tomato growers in the Trangle district.

The problems could be solved by improving the *horizontal* infiltration of water from the furrows to the rooting zone. Two methods were tested: (1) application of either wheat straw or gypsum to provide a barrier to the water, so that the soil was wet slowly; (2) cultivation of furrows and the edges of beds following each irrigation. Furrow cultivation was the best solution and the gypsum treatment was least successful.

Soil Survey

Survey of Grafton Agricultural Research Station: The survey of soils on the Research Station has been completed and a report issued. The survey shows that parent material strongly influenced soil development. Four different soil types were recognized.

- (i) Parent material, gravels—deep red soils with uniform texture.
- (ii) Parent material, alluvials associated with tributaries of the secondary creeks draining the environs of the Station—duplex soils.
- (iii) Parent material, sandstone—duplex sandy soils.
- (iv) Parent material, alluvials associated with flood plain and back swamp soils of the Clarence River—uniform and gradational textured soils.

BIOMETRICAL RESEARCH

The Biometrical Branch has continued to conduct research into areas of deficiency in the design of experiments and in the analysis and interpretation of their results, especially in the methodology of biometrical analyses. This research has also necessitated concurrent research into computing methods to facilitate these analyses.

Biometrical Methods

Assumptions, applications and interpretation of two important multiresponse methods, canonical variates analysis and repeated-measurements MANOVA, have been closely examined. Some research has been done on the analysis of qualitative data and on the parametrisation of error d.f. in Latin square designs. Research is being conducted into the adaptation of “diallel cross” designs to plant competition studies for examining competition between pairs of species, and into the development of methods for estimating the spatial correlation among observations taken at points on a regular grid.

Computer Programmes

Two methods of absorption have been investigated and incorporated into existing least-squares analysis programmes. These methods allow many more constants to be fitted for particular linear models and so facilitate a more efficient analysis of large sets of data. Intensified research commitments by the Branch have necessitated biometricians recently presenting courses to other research staff on the use of several major programmes.

AGRICULTURAL ENGINEERING

Work at the Agricultural Engineering Centre (A.E.C.) has centred on research and development to improve machines and machinery management procedures used in the agricultural industry and on the provision of specialized equipment for agricultural research.

AGRICULTURAL MACHINERY

Mechanical Harvesting of Tree Fruits

A new type of trunk and limb shaker, the Fridley, has been constructed and tested. It was compared with an imported commercial fruit harvesting machine which uses a conventional butt shaker. The Fridley removed more fruit than the commercial harvester from large red and white cherry trees, pears and oranges, but this was in the limb shaking mode which is slower than butt shaking.

Citrus Harvesting Equipment

Following a dynamic analysis of the proposed self-propelled citrus harvester by Unisearch Ltd, the machine has been redesigned to eliminate some potential problems. All major components have been obtained for the redesigned harvester and construction has commenced. The harvester will direct high velocity oscillating air streams on citrus trees previously treated with abscission chemicals, cause the trees to vibrate, and so remove the fruit.

Tillage for Grain Production

To provide the means for obtaining basic data on the performance of tractor-implement tillage systems two instrumentation systems, plus some associated equipment, have been designed and construction is well advanced. When completed, this equipment will be used to study both single cultivating tines and complete tillage machines.

Fertilizer and Seed Metering

The uniformity of seed and fertilizer metering from row to row and along the row, both by a conventional and by a new pneumatic type of combined sowing machine, being measured to determine how the new machine compares with the older type and whether improvements are required.

Equipment and Information for Extension

Convenient transport equipment for a tractor power-take-off dynamometer has been provided, plus a tractor drawbar dynamometer.

Information on farm building design and machinery costing has also been prepared for use by agricultural mechanization officers.

Farmers' Requirements for Information

Two small surveys have been completed and the results are proving to be a valuable guide for R. and D. and extension planning at the A.E.C. In fact a new series of small bulletins has been started to at least partly satisfy this need for information, and the surveys have influenced the planning of two new research projects. One will be concerned with the wear of points on cultivating implements, the other with systems analysis techniques applied to the selection of agricultural machinery for crop production.

FOOD STORAGE

Grain drying: To provide data on the safe upper air temperature limits for drying grain in radial flow batch driers, an experimental drier has been designed and most of the construction has been completed.

EQUIPMENT FOR AGRICULTURAL RESEARCH

Construction of a broadcast rice seeder, destined for Yanco A.R.C. is almost complete. This machine is designed to simulate aerial sowing of pre-germinated rice.

An instrument for measuring breast size of broiler chickens has been designed for Seven Hills Poultry Research Station.

A controlled environment room for Trangie A.R.C. is being completely overhauled and tested.

Construction and testing of humidity control equipment for glasshouses at Wollongbar A.R.C. has been finalized.

The design and specifications for 7 coolrooms have been completed. The rooms will be installed at Glen Innes, Grafton and Leeton A.R.S.'s, Yanco A.R.C. and B.C.R.I., Rydalmere. Another coolstore was designed for the Pastures Protection Board. Air conditioning systems for a grain store at Temora A.R.S. and an amenities block at Yanco A.R.C. have also been designed and specifications prepared.

SOCIAL RESEARCH

EXTENSION

Aspirations and Expectations of Sons of Farmers

The education and job plans of sons of farmers have been investigated in south west New South Wales. Boys from larger properties tended to choose farming, or other agricultural or professional careers. Those from smaller farms expected to become tradesmen or businessmen. Level of Occupational Aspiration (LOA) was related to age, scholastic ability, and job plans. Farmers had higher levels of LOA for their sons than did the boys themselves.

Decision Making and Changes on Farms

Economic success in farming can be predicted from scores of farmers' intelligence, motivation, agricultural knowledge, managerial ability, urbanization and contact with the Department of Agriculture.

Role of Specialists in Extension Methods

Special extension officers, regional extension officers (rural youth) and group extension officers kept a three month work record, while further data were collected through interviews and a mail survey of district officers.

Special extension officers spent about half their time on extension specialist work and one-quarter on administration. Regional extension officers (rural youth) spent about half their time on rural youth matters and a third on administration.

The work which district officers valued most was information collection, guidance to district officers, liaison, regional co-ordination, and planning.

The Farm Crisis and Extension

Assessment of finances on cropping farms in the Berriquin irrigation area and Parkes and Dubbo districts showed that 25 per cent of farm businesses in New South Wales might not be viable.

The author advocates that the highest priority of extension services should be to maintain economic viability of the maximum number of existing family farms. This would best be done by increasing on-farm extension contact to improve individual farm organization and management and to help farmers adapt to current economic circumstances.

Review of Agricultural Extension, 1976

There are 201 "front-line" extension officers in the State and a total of 258 professional officers. District officers made visits to about one-third of commercial farms, and had substantial contact with two-thirds of commercial farmers through personal and group extension methods. They visited an average of 89 farmers each and organized 11 group activities.

ECONOMICS AND MARKETING

Assessment of Performance in Agricultural Markets

The object of this project is the provision of a theoretical basis for analysing agricultural markets. This has required the investigation of three issues: (1) the effectiveness of the market mechanism in resource allocation or as a method of exchange; (2) the aims of government in agricultural marketing; and (3) the extent to which orderly marketing reflects government aims or deficiencies in the performance of markets.

To date very little research work has been undertaken on marketing as such. The emphasis has been directed towards price support and stabilization policies, or on the conditions of supply and final demand. Often the wider implications of such actions have not been considered. The intention of this project has been to improve the understanding of how the market functions so that a more objective method of assessing when intervention is necessary may be provided.

Estimation of Monetary Benefits from Applied Research

The purpose of this project has been to provide a method of measuring the benefits likely to accrue from applied research. The initial aim of the project has been the setting of guidelines and the evaluation of particular projects. A secondary aim has been the provision of a simple model adapted to the needs of research staff.

Rural Adjustment and Related Policy Research

A number of studies have been undertaken. These included a study of the range of government organizations involved in rural adjustment in New South Wales in relation to the types of assistance measures provided. The roles of these organizations were discussed and the need for greater co-ordination between government organizations was highlighted. In another study in the South West Region, analysis was undertaken to determine the extent and causes of any developing areas of low income and the corresponding adjustment problems. A further study focussed on the histories of farmers facing bankruptcy within the Southwest Region so that the common factors contributing to their problems could be determined.

With farm income stabilization being a major policy issue of the 1970's, research is required to determine the effects of policy measures on the rural economy as a whole. The effects are not readily determinable, since expenditure patterns of rural producers are not known in sufficient detail. A study is being undertaken to provide a detailed knowledge of factors determining farm expenditure, so that a fuller evaluation of various stabilizing policies may be undertaken.

Assessment of Credit Policy for the Australian Rural Sector

The initial phase of this project has been the description and measurement of the impact of the various policy measures designed to influence the volume, interest rate and terms of credit available to primary producers in Australia. This phase has been an essential preliminary to the assessment of alleged deficiencies in the existing rural credit market, and of proposed policy measures such as the establishment of a national rural bank.

The construction of an econometric model of bank rural lending, incorporating the main credit and monetary policy variables in this initial phase, has been completed. The model draws on, and made some developments in, the theory of investment and capital markets. From these results, together with insights provided by basic economic and financial theory and by analogy with financial institutions and arrangements overseas, assessment of new proposals and alleged deficiencies is being undertaken.

Computerized Farm Planning Service for North Western New South Wales

A computer based farm planning service is being developed which can be used by landholders, extension officers and agribusiness service organizations to assist in enterprise selection and other recurring management decisions.

The project is being undertaken in a number of stages. The first is the provision of a more reliable data base on which to make budgeting calculations. This will encourage those interested in using the information to develop their own budgets. The next stage is to obtain feedback on the cost, yield and work rate assumptions being used in the data base. From the revised data base, linear programming computer models of representative or typical farms in the region will be developed and tested. The final stage will be the provision of an operational, self-financing farm planning service. The first stage of this project has been completed with the publication of a booklet issued jointly by the Department and the Agricultural Business Research Institute entitled *Complan Handbook No. 1: Enterprise budgets for the North West of New South Wales*.

Standardization of Livestock Price Reporting

Methods of bringing about improvements in the uniformity and objectivity of the systems for collecting and recording livestock market prices have been under examination.

In order to obtain a uniform and objectively based system, standardized definitions of weight, age and condition ranges which are compatible with the A.M.B. Carcase Classification Scheme have been required. Data has been analysed from the B.A.E., carcase competitions, and the New South Wales and Victorian Departments of Agriculture using discriminant and multiple regression analysis. As a result of this, a system has been devised which has now been adopted by the New South Wales and Victorian Departments of Agriculture for price reporting.

Developmental Aid Project

A feasibility study was conducted of seed producing farms in India. The aim of this study was to investigate and document the technical and economic feasibility of establishing two separate large scale irrigated fodder seeds producing farms in two different areas of India. Australian financial and technical assistance was planned, as part of the foreign aid package. The project required full design, budgeting and technical analysis, and negotiation of details with the governments of India and Australia, and two Indian state governments.

The final report was accepted and published by the Australian Development Assistance Agency. Following acceptance by the parties involved, a total budget of \$A5 million, with an Australian project budget of over \$A1.5 million, has been approved in principle.

Cross-breeding of indigenous village cows, bred largely for draught work, with exotic breeds is capable of increasing milk yield threefold. Realization of the production potential of such cows creates demand for higher quality fodder. Since fodder crop seeds are in extremely limited supply in India, development of the fodder seed industry is an essential factor in the establishment of a viable village dairy industry. Based on the most conservative economic analysis, the primary benefits are likely to have an internal rate of return of five to twelve per cent over a fifteen year project life.

4.1 EXTENSION ADMINISTRATION

All divisions of the Department have an extension function. Most officers of the production and service divisions are in country offices where they have contact, and communicate with, farmers and a range of other clients. These clients include research workers, commercial firms, financial institutions, schools, colleges, universities, rural youth groups, other government departments and consumers.

The Division of Extension Services reviewed its professional staff structure, taking into account its continuing and general responsibility in the extension work of the Division and the need to service various rural groups with special responsibility to the Rural Youth Organisation of N.S.W. and the Agricultural Bureau of N.S.W. Following the approval of the Public Service Board the Division effected reorganization of its staff on the 1st June, 1977.

Essentially this involved the deletion of the position of Deputy Principal Rural Youth Officer, five positions of Special Extension Officer, seven positions of Area Rural Youth Officer, twenty-two positions of Rural Youth Officer and five positions of Group Extension Officer. These deletions were offset by the creation of the position of Assistant Principal Extension Officer, seven positions of Regional Extension Officer and twenty-three positions of Extension Officer.

Major considerations in this reorganization were the retention of the duties of professional officers of the Division and strengthening of Regional administration and servicing.

Concurrently with the introduction of the above changes the Rural Youth Organisation and the Agricultural Bureau were active in analysing their management structures. A 2-day seminar was held in November, 1976, involving representatives of all sections of the Rural Youth Organization, the Agricultural Bureau and the Department to discuss the various and desirable inter-relationships. Largely as a result of this seminar, the Rural Youth Council has been restructured quite radically, the constitution and by-laws of the Rural Youth Organization are undergoing review and the Agricultural Bureau has initiated its constitution. Emphasis in each case is being placed on strengthening the ties at regional and district level between members and committees of these organizations and the staff of the Department.

The Division of Extension Services, through the regional extension service in eight decentralized regions throughout the State, provides the framework under which district officers carry out their roles in extension.

Support staff provided by the Division of Extension Services at regional headquarters and some district offices includes regional extension officers, extension officers, regional publicity officers, regional clerks and field assistants. Office staff and accommodation are administered by the Division, which also provides specialized staff and services from Head Office.

At each regional headquarters there is at least one Economist who supports district extension officers. Other divisions have specialist officers at some regional headquarters to support extension generally. Officers with an extension role outside the regional extension service are country-based and head office veterinary staff.

EXTENSION STAFF

To meet the continual changes in client demands, there have been transfers and adjustments in extension staff during 1976-7.

New Positions

Regional extension officer appointed to Tamworth, Lismore, Dubbo, Orange, Wagga, Goulburn and Maitland.

Extension officers were appointed to Casino, Coffs Harbour, Taree, Forbes, Deniliquin, Parramatta, Inverell, Bega, Tamworth, Cowra, Orange, Maitland, Dubbo, Griffith, Goulburn, Murwillumbah, Bathurst, Cooma, Wagga, Wollongong and State Office Block, Sydney.

Special agronomist (extension) at Wagga Wagga; market officer Wagga; class A clerk Tamworth; district agronomist Moree; special agronomist (winter cereals) at Dubbo; research extension liaison officer Dubbo; economist Dubbo; horticulturist (vegetables) at Griffith and Windsor.

Transfers

Dairy officer at Nowra to Windsor. Livestock officer (sheep and wool fleece measurement) from Goulburn to Trangie Agricultural Research Station. Special agronomist (pastures) from Division of Plant Industry to Goulburn. Livestock officer (dairy cattle) from Campbelltown to Windsor. Herd organizer from Maitland to

Division of Dairying. Extension officer, Griffith to Leeton. Special agronomist (weeds) from Division of Plant Industry to Orange. Extension officer, Bega to Muswellbrook. Livestock officer (beef cattle and horses) from Cowra to Forbes.

Deletions

Special extension officer, Tamworth, Lismore, Maitland, Wagga Wagga, and Goulburn; regional extension officers (rural youth) Tamworth, Wollongong, Parramatta, Lismore, Bathurst, Maitland and Wagga Wagga; extension officers (rural youth) Casino, Coffs Harbour, Taree, Maitland, Forbes, Deniliquin, Inverell, Gunnedah, Bega, Cowra, Griffith, Parramatta (two), Murwillumbah, Cooma, Wagga Wagga, Dubbo (two), Goulburn, Armidale, Kempsey and State Office Block; herd organizer from South Coast and Illawarra Region; herd recorder, South Coast and Illawarra Region; locust patrol officer, Dubbo; dairy project officer, Lismore, Coffs Harbour; herd organizer, Taree and Coffs Harbour; five herd records, North Coast Region.

	North Coast	New England	Western	Central West	South- ern	South West	South East & Illawa- rra	Mid Coast & Hun- ter	Total
Regional Director of Extension	1	1	1	1	1	1	1	1	8
Regional Extension Officer ..	1	1	1	1	1	1	1	1	7
Field Assistant	3	5	2	5	4	8	5	4	36
Extension Officer	4	4	1	1	1	2	4	4	21
Research/Extension Liaison Offi- cer		1	1						2
Regional Publicity Officer	1	1	1	1	1	1	1	1	8
Italian Liaison Officer						1			1
Clerical Officer	2	3	1	1	1	2	1	3	14
Stenographers and Typists (Inc. Casual)	20	12	8	13	11	15	15	10	104
Special/Assistant Principal Ag- ronomist		2	1	1		1	1		6
District Agronomist	5	8	6	6	4	9	7	4	49
Agronomist		1							1
Research Scientist/Agronomist ..		1		1				1	2
Field Officers (Weeds)		1		1		1			3
Seed Production Officers	1	2	1	1	3				7
Tobacco Officers									2
Special Livestock Officers (S. & W.)		1		1			1		3
Livestock Officer (Sheep and Wool)		4	4	4	3	4	3		22
Livestock Officer (Beef Cattle) ..	3	4	1	2	2	2	3	2	19
Livestock Officer (Pigs)	2	2	1	2	1	1	1	1	11
Livestock Officer (Poultry)		1						5	6
Livestock Officer (Apiculture) ..		1	1	1	1		1		5
Livestock Officer (Sheep Fertility Service)			1	1	1				3
Principal Horticulturist	1								1
Special Horticulturist						1			1
District Horticulturist/Horticol- turist	6	1	1	2	1	8	2	6	27
Supervising Inspectors (P.D. Act)	1					1			2
Inspector (P.D. Act)	8	4	1	5	3	14	2	8	45
District Dairy Officer	6				1	1	2	3	13
Dairy Officer	5						1	3	9
Livestock Officer (Dairy Cattle) ..			1			1	1	3	10
Dairy Project Officer						1			1
Herd Organizers						1	2	1	4
Herd Recorders	11				2	3	14	23	53
Agricultural Mechanization Offi- cer	1	1		1	1	1	1		5
Economist	1	3	2	2	2	2	2	2	16
Field Recording Officer		1							1
Locust Patrol Officer			1	2					3
Markets Officer					1				1
Total	88	66	37	56	47	82	71	81	527

OTHER EXTENSION STAFF

District veterinary officers and their staff involved district extension officers in planning and training activities associated with exotic disease control and pesticide residues.

Veterinary officers and veterinary inspectors made many contributions to extension outlets in regions.

H.R.D. AND EXTENSION

Study Tours

Overseas. Surface stubble retention study tour U.S.A. and Canada (two officers), farm planning and marketing study tour—U.S.A., Canada and U.K. (one officer). Irrigation study tour—U.S.A., Netherlands (one officer). Rotary foundation group study tour—Iceland (one officer).

Interstate. Sixty officers travelled interstate on thirty-three different study tours to all States of Australia.

Intrastate. Twenty-three officers studied on seven fact finding tours within New South Wales.

Technical Training for Officers

Regional Training

It was possible to commence the on-property training scheme for Agronomists with one officer, which involved him in day to day farm operations in the Bega area. One livestock officer (sheep and wool) undertook similar training during 1976.

Twelve officers undertook training in regions prior to district appointment.

Statewide Workshops and Courses

Communication Skills Workshops. Three workshops were held in 1976-7 for extension officers. The workshops were intended for extension officers who joined the Department of Agriculture between 1971 and 1976 and have had limited experience. They have an initial training programme in communication through mass media (press and radio), communication in face to face situations (personal and group) and in visual aids and photography. Two workshops were held for research officers.

Audio-Visual Workshop. Kodak (Australasia) Ltd offered the Department of Agriculture a 2-day workshop on design and preparation of audio-visual series. The workshop was attended by one or two officers from each division of the Department of Agriculture in Sydney.

Livestock Market Reporting. Briefings were held throughout the State to familiarize district officers, veterinary officers and P.P. board rangers with the newly introduced livestock market reporting system.

Marketing Workshop for District Horticulturists. A marketing workshop was held at Gosford for twenty-two district horticulturists. Sessions were led by both departmental and industry resource personnel.

Subject matter covered included: the basic principles of marketing; the strengths and weaknesses of various types of producer marketing organizations such as co-operatives, statutory boards and C.O.D. type arrangements.

Grain Cleaning. A training school was conducted for agricultural mechanization officers on the design, construction and operation of eccentric grain cleaning screens. The screens, developed within the Engineering Section can be built for less than \$500. It is capable of removing most foreign seeds from the grain sample to meet G.E.B. requirements without dockage.

Brucellosis. Training courses on the brucellosis eradication campaign were held in the Grafton and Armidale District Veterinary Officer areas—forty-seven newly appointed field assistants (brucellosis) attended.

Carcase Classification. A seminar and symposium, at Dubbo—forty-two sheep and wool and seventeen beef cattle livestock officers.

Conferences. Conferences of district agronomists, district horticulturalists, District dairy officers, livestock officers (sheep and wool), seed production officers, regional publicity officers and veterinary inspectors were held during 1976-7.

Other Courses. 113 Conferences and workshops were attended during 1976-7 throughout the State. Topics varied and included National Outlook Conference, National Workshop on Counselling in Rural Adjustment, Middle Management courses, Cereal Improvement Conference, Regional Planning Conferences, Wool Harvesting Seminar and Beef Marketing.

Graduate and Post Graduate Study

During 1976, five officers completed the Graduate Diploma in Extension at Hawkesbury Agricultural College. Six officers have commenced the course in 1977.

Three officers undertook the Irrigation course at Yanco Agricultural College in 1976-7.

One officer is attending the Graduate Diploma in Food Science at Hawkesbury Agricultural College during 1977; two completed the course in 1976.

A district agronomist is undertaking a Diploma in Agricultural Science in Rangeland Management at the University of New England in 1977.

One officer completed doctoral requirements at the University of Wisconsin.

One officer completed requirements for award of the Bachelor of Economics degree and one officer was awarded the Post Graduate Diploma of Agricultural Economics by the University of New England.

Twelve district extension officers are pursuing external studies at University of New England, Macquarie University and Colleges of Advanced Education,

NEW DEVELOPMENTS

Extension Policy. The Regional Director of Extension, Leeton, was seconded to the Extension Research and Evaluation Unit for a 3-month period to undertake a study of the farming situation and implications for extension. The resulting report titled "The Farm Crisis and Extension" was circulated throughout the Department.

The major conclusion of the report was that highest priority should be given to on-farm extension to help farmers maintain economic viability and outlined ways in which this may be achieved.

The Extension Policy Committee has accepted the conclusion and recommendations and action has been initiated to implement the proposals.

Part-time Farmers. It is difficult to estimate the number of commercial agricultural holdings where the farm income is supplemented by off-farm sources. An analysis of the statistics by regional economists indicates that about one third of the 11 849 agricultural holdings in the mid-coast and Hunter Region of one half hectare or more were unused in 1974-5. Of the remainder which are used, half of them had a gross value of agricultural production of less than \$5,000 in 1974-5.

That these holdings are still being operated seems to indicate that off-farm income would be important. Proximity of farms to the great metropolitan areas of Sydney and Newcastle makes off-farm employment a possibility for the farmer or his wife and family.

Dairy Industry. The allocation of milk quotas allowing dairyfarmers increased access to the fresh milk market with a potential for increased income has brightened the outlook for the majority of North Coast dairyfarmers.

In view of the high average age of dairyfarmers and because of the higher levels of management required to produce and maintain quotas, it is doubtful whether the allocation of quotas will do more than slow down the existing trend to move out of the industry.

In the short term there is evidence that with the prospect of higher incomes, some dairyfarmers are becoming more receptive to extension advice and there is increased interest in the production of pastures and fodder crops.

Budget Talks. Publicity Officer, Mr A. J. Batchelor and Economist, Mr P. L. Gisz, South East and Illawarra Region, participated in the prebudget lock up of journalists for both the Federal and State budgets.

Both gained useful experience and established many good media contacts.

Wheat. Wheat production has expanded significantly throughout the State in recent years. Wheatgrowers have been fortunate to experience four above average yielding crops in a row.

Allied with the expansion of wheat cropping has been a heavy investment in new plant and machinery by producers. The situation has been reached where many farmers are now locked into a wheatgrowing programme. A marked downturn in wheat prices or the inevitable advent of a bad season is likely to have serious repercussions on farm viability.

Despite the run of good seasons and fair wheat prices, the financial standing of many mixed sheep/wheat farmers is not sound.

To meet this situation extension officers are placing greater emphasis on alternative crops, such as lupins and linseed, machinery syndication and a shift to sheep enterprises.

Spotted Lucerne Aphid. The appearance of this exotic insect pest has virtually spelt the death knell for one of the State's most versatile and productive pasture species, Hunter River strain lucerne. In the Western Region by autumn 1977, 75 per cent of lucerne had been devastated and the remaining area severely affected.

While resistant strains of lucerne may rectify the problem in the future, the short-term outlook is not encouraging. The cost of this catastrophe in terms of productivity and hard cash to the primary producer has been and will continue to be for some time ahead extremely high.

Extension strategies to cope with the problem are concentrating on: Sowing resistant strains as soon as they become available; use of other pasture species, e.g., subclover where practicable; substituting winter and summer fodder crops to fill in feed gaps; economical use of insecticides as a short term control measure in irrigated stands.

Rural Adjustment. (a) Adjustment problems in the Western Division of New South Wales have been the main concern of the region's Interdepartmental Rural Adjustment Committee.

A survey of bank managers, stock agents and business houses was carried out by the economist and district livestock officer (sheep and wool) at Cobar this year. The survey classified the viability status of graziers in that area as follows:

30 per cent to 40 per cent were presently financially sound;

45 per cent to 50 per cent were marginally viable;

15 per cent to 20 per cent were overcommitted with no prospects of redemption.

As an additional project the Committee has moved towards phase two of its programme in that area which involves: Educational programmes to inform graziers of the various rural assistance schemes and services available; development of training programmes in farm business management and production technology; provision of short term training courses on farm welding, small engine repair, wool classing. These courses are being arranged through Department of Technical and Further Education with facilities being provided by Cobar Mines Ltd.

(b) A "Helping Skills" workshop sponsored by the New England Regional Rural Adjustment Committee represented a significant development in training for adjustment counselling. The participants were drawn from a wider range of departments and instrumentalities than for previous workshops, and this time included members of the Commonwealth Public Service for the first time.

Arising out of workshop issues, participants met with a member of the Kellogg Rural Adjustment Unit, and discussed with him their concerns and recommendations from that unit's counselling workshop. They made a number of recommendations for the development of co-operation and co-ordination of services within rural communities, for consideration by the regional committee.

Remote Sensing. A number of officers, became deeply involved in field aspects of a co-operative project between CSIRO Division of Mineral Physics and the Department. In this project satellite information is checked against ground information on selected farms in the Gunnedah/Tamworth area.

The initial task involved the identification of farm owners at some 194 nominated points on a Landsat 2 photograph, then obtaining their co-operation in the supply of farm plans and information about their 1976 farming activities.

It proved to be relatively easy to map individual farms on the photograph from the plans provided by farmers, of whom about 102 responded. Some 50 of the nominated points were discarded because they fell in forested or hill country, or were duplicated on the one property.

The degree of interest and co-operation of officers and farmers was excellent.

Complan. The Reserve Bank of Australia, through its Rural Credits Development Fund, has provided a sum of \$28,000 for a computerized farm planning project being developed by Mr B. D. Buffier in co-operation with the Agricultural Business Research Institute at the University of New England.

The main achievements in the year were the further development of computer models and the preparation and printing of *Complan Handbook* No. 1. This handbook contains a wide range of budgeting information for virtually all livestock and crop enterprises which can be undertaken in the New England Region. Half of the 1 000 copies printed were sold within 3 months of publication.

Mr Buffier was awarded a Churchill Fellowship which enabled him to study computerized farm planning systems overseas in relation to the Complan project.

Land Use Developments. The Director, Pesticides and Environmental Studies has co-ordinated specialist assistance from extension personnel to an increasing number of local government authorities throughout New South Wales in connection with the assessment of land for suitability for agricultural purposes. Of particular interest have been situations where re-allocation of land to urban development is under consideration, and likely to involve suspension of existing zoning regulations to permit developments.

Councils have been made increasingly aware by the Department of the irreversible nature of good agricultural land and the high priority need for its preservation. Planning should therefore aim to minimize the irreversible loss of productivity from soils.

Disease Reporting. A disease reporting component was added to the proposed National Pig Carcase Measurement and Information Service. The pilot run at Blayney Abattoir proved effective in recording disease information at slaughter during routine meat inspection.

This offers a means by which the producer can obtain and utilize vital information on diseases. It should allow him to modify husbandry methods and plan control programmes in order to minimize or eliminate costly diseases.

SUPPORT FOR EXTENSION

Australian Extension Services Grant Report for 1976-7

The Chief, Division of Extension Services, is responsible for the administration of the Australian Extension Services Grant Funds made available by the Commonwealth Government through the Department of Primary Industry to enhance the Department's extension services and applied research programmes.

In 1976-7, the allocations for the various projects aggregated \$2,426,203 as against \$2,193,422 in 1975-6, an increase of 10.61 per cent.

The following table comparing 1975-6 and 1976-7, summarizes the projects and allocations.

Project No.	Title	1975/76	1976/77
		\$	\$
501	Agronomy	275,350	368,808
502	Horticulture	142,463	144,151
503	Animal Industry	162,196	185,677
504	Dairying	128,732	138,250
505	Biometric Services	20,000	20,000
506	Extension Services	589,793	727,885
507	Engineering and Machinery Services	130,666	147,904
508	Agricultural Trainees	8,050	4,000
509	Publications	74,250	96,412
510	Library Services	30,000	34,500
511	Training Study Tours. Overseas	3,500	12,000
514	In service Training	14,478	34,800
515	Post Graduate Training	2,000	2,000
517	Economic and Market Services	254,393	315,601
518	Biological and Chemical Research	120,668	144,215
520	Buildings and Other Major Developments	236,883	50,000
		2,193,422	2,426,203

The above table reflects increased provision for training, and new extension initiatives, particularly in projects 501 and 506. It also reflects a phasing out of support for buildings and agricultural trainees. The number of salaried positions was reduced in 1976-7 to 126 compared with 129 during 1975-6.

Salaries were again the biggest single item of expenditure. They accounted for 75 per cent of total expenditure, the same as for 1975-6. Positions supported included sixteen district extension officer positions, fourteen regional extension staff positions, twenty-eight field assistants, fourteen economists, one field recording officer, seven agricultural mechanization officers, seven miscellaneous extension support positions, fifteen research officers, eleven research field assistants, nine technical officers or assistants and four dairy project officers.

The Research Laboratory at Yanco, and the Infectious Agents Complex at Glenfield, both four-year projects, were completed during 1976-7 costing \$300,489 and \$148,245 respectively.

Extension Assistance

The New South Wales Oilseeds Marketing Board donated \$1,880 to the Western Region for a research/extension project designed to provide economic and technical information on oilseed production in the Macquarie Valley. The grant has been used to acquire audio-visual aid equipment, prepare an audio-visual documentary and a display exhibit depicting applied aspects of oilseed crops and production. The project is being carried out by district agronomists and research officers of Trangie Agricultural Research Station, assisted by the Regional Publicity Officer.

The C. B. Alexander Trust donated an annual grant of \$1,000 to the Orana Rural Training Project. The grant is used to assist with the development and implementation of educational programmes for farmers in the Western Region.

Regional Publications

I.R.E.C. again provided funds jointly with the Murray Research and Extension Committee, Australian Fertilizers Ltd, The Phosphate Co-operative of Australia Ltd, and Arnotts Biscuits Ltd for the reprinting of the coloured leaflet *Irrigated Wheat and Barley Sowing Guide* compiled by District Agronomists and Special Agronomist (Irrigation) of the South West Region. Total cost of publication was \$364.

An *M.I.A. Orchard Spray Calendar* of fifty-six pages was compiled jointly by the Special Horticulturist, Entomologist and Pathologist and published by J. T. O'Mara and Sons. About 2 000 copies were made available at no cost to the Department.

The cost of printing and distributing a newsletter to all citrus growers in the Central Coast is borne each year by the Central Coast Agricultural Research and Extension Council.

Dairy factories in the region through the co-operation of the bulk tanker drivers make possible the distribution of regular newsletters to dairy farmers. Each month the drivers deliver a copy of a newsletter to each of the 1 355 dairyfarmers in the mid-coast and Hunter Region.

Support by Industry

Pasture Grazing. Australian Fertilizers Ltd continued to provide expertise, fertilizer and facilities for the "Cattle-man" project at Nowra and the Bega Co-operative Society will be providing a major input in terms of staff, computer service and supervision for the "Dairyman" project at Bega.

Australian Fertilizers Ltd have supplied the superphosphate for the trials and major components for the electric subdivisinal fences for grazing trials at Tumut and Tumbarumba.

Australian Fertilizers Ltd, University of New England and CSIRO gave valuable assistance and financial support for the Productive Pastures Project on the Northern Tablelands. A further ten demonstration sites have been included in the project.

Marketing Seminar. The Institute of Administration, University of New South Wales, joined with the Department in co-sponsoring a 4-day residential marketing seminar for selected farm leaders and district livestock officers. It was held in Sydney and participants included producer representatives of the beef cattle, sheep, pig and fruit industries. In addition, ten district livestock officers and one Departmental economist attended.

The panel of session leaders was made up of some of the most outstanding marketing authorities in Australia.

Lupin Growing Contest. This programme is a joint one involving the Wagga Agricultural Bureau, the local Radio Station 2WG, and the Department of Agriculture. Great assistance, both financial and organizational, has been received from these bodies.

The Radio Station is providing first prize, which is a trip to New Zealand, plus spending money and publicity. Agri-businesses in Wagga are supplying the rest of the prizes. A conservative estimate of the value of the publicity is \$2,000.

The Australian Wool Corporation. Provided financial assistance for attendance at conferences and courses, such as the Australian Sheep and Wool Refresher Course and the Wool Harvesting and Sheep Handling Seminar at Wagga; financial assistance in the form of salaries and operating costs for one professional officer and a field assistant engaged in the Sheep Fertility Service at Wagga; technical assistance in objective clip preparation and the development of labour saving devices.

The Australian Meat Board. Provided technical assistance in the conduct of extension activities and carcase competitions; financial assistance in the publication of information in relation to carcase classification.

4.2 PROGRAMMED EXTENSION ACTIVITIES

TABULATED SUMMARY OF OFFICERS' EXTENSION PROGRAMMES

In the diverse agriculture of New South Wales most crops and/or enterprises are subject to changing emphasis requiring continual modification of programmes.

Basically increased attention is being paid to the overall viability and profitability of farms. Regional consideration of programmes and their application in multi-disciplinary approach are being given more emphasis, supplanting to a large degree the isolated efforts of individual officers. The main theme is efficiency of production on a farm basis rather than increasing production as a whole.

By listing the programmes of all extension officers from each division into functional categories, it is possible to see the trend of the Department's programmed activities, regardless of the differences in the technical nature of individual programmes. Inevitably some programmes encompass more than one function, but in the interest of simplicity, they have been listed under their main function.

Type of Programme	Regional and District Officers					
New Technology	..	..	..	..	..	82
Production Technology	..	..	..	..	..	311
Trials and Demonstrations	..	..	..	..	..	94
Farm Business Management	..	..	..	..	..	57
Marketing	..	..	..	..	..	33
Communications and Education	..	..	..	..	..	112
Rural Adjustment	..	..	..	..	..	18
Rural Youth	..	..	..	..	..	44
Community Development	..	..	..	..	..	11
Public Relations and Liaison	..	..	..	..	..	20
Consumer Protection and Education	..	..	..	..	..	12
Environmental protection	..	..	..	..	..	4
Regulatory	..	..	..	..	..	5
Other	..	..	..	..	..	19
						822

NATIONAL AND STATE OBJECTIVES

Grain Pest Campaign

This campaign continues to be of great importance because of strict quarantine laws in overseas grain markets and increasing resistance of grain pests to control by pesticides. Responsibility for the campaign was transferred to the Division of Plant Industry in 1976. A meeting of all those concerned with the campaign, including marketing and bulk handling authorities, was held in November, 1976.

The aims of the campaign have been difficult to achieve because of lack of powers of inspection and penalties and this has encouraged widespread complacency among producers. In addition, the design of current harvesting machinery and grain storages renders difficult the carrying out of cleaning and preventative treatments.

A four stage awareness campaign was organized by the Division of Extension Services. Timely reminders are sent to extension officers so that farmers can be advised to take proper measures at appropriate times, e.g., cleaning out and fumigating headers well before harvest. Extension officers have been successful in maintaining an awareness of the problem by means of field days, demonstrations, use of mass media, and distribution of publications. Regulatory officers have continued to survey commercial storage premises to ensure that appropriate treatments are carried out when necessary.

A meeting, attended by delegates from all States, was convened in Melbourne in March, 1977, to discuss imposition of penalties for delivery of insect infested grain. This meeting generally agreed that a dockage scheme for deliveries containing insects was not practicable because of sampling limitations, excessive cost and legal difficulties. As the farm appeared to be the main source of infection, it was agreed that preventative measures should be concentrated there. A further meeting was held in May, 1977. The various States put forward separate proposals to overcome the problem. These reports and discussions at the meeting were incorporated into a report for submission to the Australian Agricultural Council meeting in July, 1977. Basically the scheme, as far as New South Wales is concerned, is that growers delivering grain infested with insects will be visited by an extension officer who will give advice on eradicating insect pests. If a farmer is reluctant to carry out treatment, he will be visited by an inspector (Plant Diseases Act) who will initiate regulatory action.

Brucellosis in Cattle

Uncertainty of future funding levels and arrangements delayed the implementation of the test and slaughter phase of the National Eradication Campaign. Pilot activity commenced in December in the northern part of the State and was escalated in April/May by the additional appointment of forty-nine field assistants for collecting blood samples from cattle in the field. This resulted in an increase in the emphasis on extension and extension publications were circulated widely in the areas under test and slaughter procedures.

Extension work was again directed at encouraging maximum use of vaccination. Compulsory calfhood vaccination continued in the coastal district and the Moree water course country and was extended from the Berrigan Protected Area to include seven pastures protection districts in the District Veterinary Officer, Narrandera region. Elsewhere all known infected properties are included in the compulsory strain 19 programme.

Publicity also aimed at encouraging cattle owners to observe requirements under the Stock Diseases Act relating to the use of numbered tail tags which allow traceback of infected stock to the property of origin. Field and abattoir surveys continued to identify herds for free government-subsidized vaccination.

Mastitis Control

Monthly somatic cell counts of the bulk milk of all dairymen in the State formed the basis of the Mastitis Advisory Service conducted by the Department in association with the N.S.W. Dairy Industry Authority. The advisory work based upon these monthly counts involved officers from the Divisions of Dairying and Animal Industry.

The State average cell count over the year was 542 000 per ml. This figure is still too high and indicates the need for continuing education. Extension officers rely on the results of the somatic cell counts to monitor individual farm, factory and district levels of mastitis. Extension objectives based on a realistic district or factory level were formulated.

During the year the format of the Mastitis Advisory Service docket was simplified. This now shows for each herd its position in relation to other suppliers to the factory as well as the level of mastitis control indicated by the average cell count over the last six months. The estimate of the amount of milk being lost each week due to mastitis is also shown. The information provided on the docket is aimed at increasing farmer motivation.

Results of the survey of all suppliers to two factories identified a number of factors as being associated with low cell counts. However, none of these explained the continuing factory difference in bulk milk cell count.

Articles were published in Dairy Topics and the New South Wales Dairymen dealing with mastitis control generally and the Mastitis Advisory Service in particular. In addition regional bulletins were produced.

Exotic Disease

Farmer and community awareness of the threat posed by exotic diseases was maintained. A major exercise of 5 days duration in the Cooma and Bega districts simulating an outbreak of foot and mouth disease proved of immense value in providing "real life" situations.

It provided the opportunity for extensive radio, television, newspaper and face-to-face extensions on exotic diseases. This included a national television coverage on Channel 7.

It demonstrated the need to modify the lists of resources and risk enterprises. A Newcastle disease control exercise conducted at Maitland assessed the impact of this disease on a large integrated organization. Realistic figures provided by this organization established that the cost of loss of production would quickly outweigh the cost of slaughtering even a quite considerable number of infected flocks.

Pesticide Residues

Subsequent to the proclamation of the Stock (Chemical Residue) Act of 1975, a programme was implemented to inform primary producers and those in associated industries of pesticide residue problems.

Mass and group media have been used extensively to create awareness to the problem and to foster safe and responsible use of agricultural chemicals.

Extension officers combined with veterinary personnel to provide information on the residue problem at farmer meetings, field days and through newspaper columns and newsletters.

The programme has created a high degree of awareness and there has been an evident response from landholders and distributors of chemicals to observe the principals of good agricultural practice and chemical usage.

The news of cattle properties being quarantined made producers more conscious of residue problems.

Livestock Market Reporting Service

Livestock Market reports throughout New South Wales vary in standards and usefulness. Producers of livestock are agitating for more and better market information. The Department has set out to establish standards for livestock market reporting throughout New South Wales and Australia.

Other activities include: regional briefing sessions for Departmental Officers; issue of mass media releases—press, radio, television releases, pamphlets; demonstrations at appropriate field days including several at saleyards.

The reporting system has been accepted widely by all sections of the livestock industry, as a significant improvement on existing reporting systems. It has been adopted for reporting at Homebush by the Department and also at Orange and Newmarket (Victorian Department). Distribution of reports has increased significantly since the introduction.

Sheep Blowfly

The sheep blowfly is a major economic problem to producers in New South Wales. It is estimated to cost the industry in excess of \$50 million per annum. The problem is being compounded by the tolerance of the blowfly to chemicals used for its control. There are a number of practices that can be implemented to curb the fly and reduce dependence upon chemicals.

Officers have received the latest information relative to fly control. Producers are being encouraged to use an integrated approach to fly strike prevention. This involves correct tail length, mulesing, selection of resistant sheep, jetting of older sheep and other management practices.

District officers have co-operated with research officers in jetting trials to evaluate the effectiveness of existing and new insecticides for the protection of sheep against fly strike.

Officers have also received training in the technique of chemical ringing/mulesing and a number of field trials are in operation, testing this technique.

Carcase Classification

The introduction of carcass classification as developed by the Australian Meat Board, will create potential for major changes in the livestock industries. Extensive effort is being directed towards developments in the following areas:

- (a) Identification of the relationships between production and husbandry practices and carcass specifications.
- (b) Correct producer interpretation of carcass data feedback from the meatworks.
- (c) Producer and agent awareness of market requirements and the identification of price differentials between classifications.
- (d) Producer and agent skill in drafting stock for sale that will meet the new requirements.
- (e) Alternative marketing systems.

Progress in this objective during 1976–7 concentrated on officer training via printed material and seminars.

A slide/tape series for carcass classification extension is being prepared in association with regional publicity officers and Australian Meat Board.

The Department has also co-operated with the Australian Meat Board in preparing a brochure explaining the carcass classification data contained on the computer print-out which will be sent to all livestock owners following slaughter and classification.

The Department is co-operating with other State Departments of Agriculture in undertaking pilot runs of the proposed Pig Carcass Measuring and Information Service. Officers are at present assisting in assessing the impact of the pilot runs on pig producers, stock buyers and processors involved.

Considerable extension activity has been directed, not only to the pig producer, but to all sections of the trade to highlight the benefits that will accrue to all through the implementation of carcass classification.

Sheep Reproduction

Improvement of lamb marking percentages is one way of increasing the efficiency of production from the sheep enterprise. With the phasing out of the Sheep Fertility Service, financed from the Wool Research Trust Fund, officers of the section are incorporating sheep investigation trials as part of their normal extension activities. A manual of techniques and fertility investigation procedure is being prepared for use by district officers to assist them in carrying out sheep fertility field trials. In the southwest part of the State, an intensive extension programme has been aimed at reducing the effects and incidence of clover disease in sheep, a major cause of reproductive loss in that area.

Wool Clip Preparation

The preparation of the State's wool clip in an objective manner is one of the aims of the Australian Wool Corporation's wool marketing plans. All sheep and wool officers received special training objective clip preparation. The Objective Clip Preparation (O.C.P.) Implementation Committee with representation from the Australian Wool Corporation, Department of Rural Studies, brokers associations and the New South Wales Department of Agriculture, plans field days and instruction on objective clip preparation on a statewide basis. District officers, in conjunction with local brokers and the Australian Wool Corporation representative, plan the functions at a regional level. Twenty-five of these functions were held. District officers also organized similar functions on their own initiative.

It is apparent that the O.C.P. standards are gaining wide acceptance and adoption. However, because of the traditional nature of the wool industry extension on this topic will need to be continued over a number of years.

Sheep Handling

Employed farm labour has decreased substantially over recent years due to the declining rural economy and the shortage of reliable workers in country areas.

This situation combined with the rising cost of contract labour for shearing and crutching has influenced many producers to look at labour saving devices, particularly for handling sheep.

Over the past 4 years, a large number of sheep handling and crutching devices have been manufactured, ranging markedly in operation and cost. Sheep producers showed a lot of interest in these devices but were naturally confused as to which units to consider.

Officers have attended refresher courses and seminars on sheep handling and have organized many demonstrations of new equipment, wool shed layout and sheep yard design. These demonstrations attracted large attendances, e.g., 1 000 at the Leeton Woolarama and 300 at Gilmore.

The request for printed material has been met by distributing 1 500 copies of *Circular Sheep Yard Designs* and over 1 000 copies of plans for a sheep handling device.

In June, 1977, the Australian Wool Corporation conducted an evaluation seminar on the "Australian Wool Harvesting Programme". Officers contributed two papers and made a significant contribution to the final evaluation and recommendations.

Objective Measurement

Merino ram breeders are being encouraged to make full and proper use of the new Fleece Measurement Service operating from Trangie Agricultural Research Station. The service can be used as an initial screen to identify superior rams and also to grade rams for sale. Success is facilitated by close personal contact with breeders.

This service commenced in the late spring of 1976 and to date, over 3 000 samples have been processed. District officers provide assistance with fleece weighing of rams at the stud level and forward wool samples to the Trangie laboratory for a fibre diameter test. The resultant information is returned to the breeder via the district officer who discusses the results with the breeder.

Drought Preparedness

Grazing pressure in terms of sheep equivalents carried remained high in New South Wales. The area sown under winter cereals increased for 1977 imposing further pressures on grazing land. The need for extension awareness regarding drought preparedness and fodder conservation is apparent.

During 1976-7 a *Drought Feeding for Sheep* publication has been completely re-written and converted to metrics and metabolizable energy feeding standards. Extension officers received special briefing on the use of metabolizable energy standards in drought feeding recommendations.

Dairy Product Quality Assurance Programme

The programme involved 14 surveys of selected dairy products in addition to routine trouble-shooting and follow-up testing; also the preparation and distribution of over 1 000 starter cultures.

In all, 2 607 micro-biological and 3 551 chemical analyses were carried out.

The information from these tests is made available to the appropriate factory managers and dairy officers to assist them in improving the quality of dairy products.

REGIONAL OBJECTIVES

Regional objectives in programme planning have been defined where district officers are involved with problems of a particular agricultural enterprise across district boundaries or where officers of different divisions co-ordinate their activities to tackle a particular problem on a regional basis. Support in co-ordinating efforts or technical assistance is provided where necessary by Regional Directors of Extension, district veterinary officers, regional extension officers, regional publicity officers, subject matter specialists, extension officers, economists and agricultural mechanization officers.

Examples of regional objectives and achievements during the year were:

Gathering, disseminating and using information on costs and returns of agricultural enterprises and farming systems: Mid Coast and Hunter Region.

Large Scale Dairying. All dairy officers and dairy cattle officers in the region met at Seven Hills in October, 1976. With the objective of learning more about the problem, three of the officers went on a study tour in Victoria and are now in a position to pass information on to their colleagues.

Strawberry Growing. To meet the need for more information on costs and returns in strawberry growing the district horticulturist, and the assistant horticulturist, Windsor, together with a regional economist prepared and published a *Local Consensus Data Report*.

Dairying in the Gloucester District. The dairy officer, Gloucester, and a regional economist working through a small group of farmers have collected information for a *Local Consensus Data Report*.

Citrus Growing at Gosford. Although citrus growing on the Central Coast was the subject of a traditional cost-of-production survey during the year, the district horticulturist, Gosford and a regional economist could see the value in preparing a *Local Consensus Data Report*. This is in production and apart from its extension value, will serve as an interesting comparison with the survey results.

Farm Management Records for Poultry Farmers. The computerized service organized at Seven Hills was expanded from 20 farmers, 32 flocks and 187 000 birds to 29 farmers, 46 flocks and 300 000 birds during the year.

Sheep Fertility

The reproductive performance of sheep flocks in the Western Region has a significantly higher potential than is currently being attained.

In an effort to remedy this situation, district livestock officers (Sheep and Wool) in the Western Region have continued on programmes of investigational and extension activity to: identify causes of reproductive wastage by conducting an investigational programme of diagnostic trials on properties with known problems; conduct field trials in conjunction with group extension activities to demonstrate the effect of various management strategies on sheep fertility.

Investigations and demonstrations were conducted on 18 properties in the Region.

Of particular significance was the continuation of investigations into feral pig predation of lambs. Feral pigs have been established as a major cause of reproductive loss in Western New South Wales. Work continued on the use of electric fencing to deter pigs from entering lambing paddocks. In conjunction with group extension activities and media coverage the problem definition and possible solutions have gained wide acceptance.

Two investigations demonstrating the effect of skin fold on the reproductive performance of Merino sheep gave significant results. Extension of the local trial findings created considerably more interest and acceptance than earlier research results on the same subject.

Clover-Induced Infertility

The highlight of activities associated with the project in the Southern Region was the staging of a comprehensive quality exhibit at six country shows, the Henty Machinery Field Days and in three town offices. The display dealt with the physical problems of clover infertility in ewes, the various identifying features of the good

and the bad clover varieties and the recommended measures required to replace problem varieties with low oestrogen types. Complementary to the display has been a pamphlet with colour plates. Over 1 000 copies have been distributed to date.

The changeover of the sowing of low oestrogen varieties—Seaton Park and Daliak, in place of Dwalanup has now almost been accomplished.

The largest seed merchant at Lockhart sold more than twice as much Dwalanup as Daliak in 1976. This year no Dwalanup has been sold whilst Daliak sales have increased eightfold and now dominate pasture seed sales.

The next objective is to get farmers to identify subclover varieties so that they can observe the effectiveness of the new varieties in dominating the old. This will allow them to select the varieties and adjust establishment techniques to suit their conditions. Complementary to this, three paddock demonstrations using Daliak, Seaton Park and Trikkala are currently being sown in or bordering the Narraburra Shire.

Control of Fruit-Fly

Dry seasonal conditions greatly assisted the control of fruit-fly. No serious outbreaks occurred, but flies were trapped at Hillston, Yenda, Stanbridge and Narrandera and a larval infestation was found at Cudgel. Prompt action prevented development of serious consequences.

Under the auspices of I.R.E.C. importers of fruit to the M.I.A. have agreed to contribute to a voluntary levy at the rate of 5 cents per package or 20 cents per tonne to provide a fund for fruit-fly control. It is expected that the levy will yield up to \$6,000 annually and may be used for materials, equipment, hire of labour, etc., in fruit-fly control activities.

The South West Region produced a series of ten slide sets depicting fruit-fly control, each containing fifty-nine slides and commentary tape. A set was issued to each region in the State and one set was forwarded to the Western Australia Department of Agriculture at their request.

Nematodes in Vines

Officers at Leeton initiated a comprehensive programme to survey winegrape plantings to determine the extent of nematode infestation and to attack the problem. As an adjunct to this programme it was decided to test the Opinion Leader method of extension and a survey was conducted to define the key people, in comparison with traditional formal extension methods. I.R.E.C. provided the sum of \$600 for the purchase of a fumigator and resistant vine rootstocks are being propagated at the Viticultural Research Station. The project is long term but significant progress has been made in this first year.

School Leavers Entering Agriculture

Economic, social and political influences are increasingly working against the interests of the primary producer. It is a prime role of the extension services to work for the betterment of primary producers and for the development of soundly based rural industries.

Young people contemplating a rural vocation need to be alerted to the situation and to be aware of the personal qualities and skills required by the future farmer.

This programme is aimed at alerting school leavers, especially those contemplating a farming career, to the situation in and problems of present day farming.

It is also aimed at making a continuing contact with those young people who eventually decide to take up farming.

This year, talks were delivered by extension staff to about 300 students at 17 secondary schools and colleges. Of these about 90 indicated they proposed to take up farming sooner or later. In the follow-up after they had left school, only 10 confirmed they had entered a rural occupation. Many others had decided to remain at school or undertake some form of tertiary education.

Cattle Production Efficiency

Low cattle prices, overproduction and cost price squeeze mean decreased returns and higher costs. Probable outlook is long-term recovery, but short term worsening of the situation. Producers' ability to survive until prices recover will depend on ability to maintain herds and restrict input.

Producers are conscious of the need to reduce inputs. Most breeding herds are being maintained or slightly reduced in size, with inferior and non-productive breeders being culled.

The increased number of females being sold through the Moree yards is a good indication that herd reduction is occurring. The pleasing thing is that females are being

culled more often because they failed to produce calves, or because the calves produced had poor growth rates.

Efficient Use of Fertilizer

Crops. Increasing use is being made of fertilizers throughout the New England Region, often with a lack of knowledge on the part of users. Many farmers are unaware of the benefits of fertilizers. Soil fertility is running down on the heavier soils.

Increased number of soil tests, 1974–5 100, 1975–6 400, 1976–77 400. Number of farmers using test strips increased from about 4 in 1974 to about 100 in 1977.

The area treated with anhydrous ammonia at Tamworth, using more than 30 kg/ha N increased from 1974 700 ha, 1975 2 800 ha, 1976 13 000 ha and 1977 25 000 ha (estimate).

A pleasing aspect is the number of people prepared to go to the extent of putting in their own trials and harvesting them to study the results. This is considered to be the real answer in determining requirements because in this way farmers can build up a set of data based on applications, seasonal conditions and yields upon which they can base future needs.

Pastures

New England. Increased cropping areas, decreased use of fertilizer and increased stocking rates have combined to place a heavy demand upon pastures. The utilization of pastures is of the utmost importance in maintaining animal productivity.

Demeter fescue is now the most popular species sown on the northern tablelands. This is the first year the sales of fescue exceeded those of perennial ryegrass.

The sales of Sirosa phalaris doubled over the past year despite the high seed price. This increase in Sirosa sales is expected to continue to the extent that phalaris will again become a major species sown in the Armidale district.

In addition to wanting to know the best pasture species to sow, graziers are showing considerable interest in obtaining the best out of their existing improved and native pasture species.

The area of improved exotic species is declining due to the reduced topdressing activity and reduced area sown this year.

Awareness of the value of topdressed naturalized pasture is gaining momentum. Two native grass identification workshops held were well-attended.

More research is needed into the management of natural pastures to encourage the ecological change to the more frost tolerant, palatable grasses.

This objective involved co-operation with the District Agronomists at Armidale, Inverell and Glen Innes and with the district livestock officer (Sheep and Wool), Glen Innes, and involvement in field trials run by these officers. This team approach was effective in reaching a larger audience with a greater pool of expertise.

Central West Region. The Central Tablelands is primarily an intensive livestock grazing area based on improved pasture species. It is traditionally a high superphosphate input area. With recent increases in the cost of fertilizer it has become particularly important to look closely at the efficient use of fertilizers.

Following the removal of the superphosphate bounty and the rise in the price of superphosphate, usage of the fertilizer declined by 77 per cent as indicated by commercial sales in the area. Although bulk superphosphate application has increased by 233 per cent in the period 1976–7, the quantity used is 33 per cent below the average applications for the season prior to the boom year, 1973–4.

Research on the Central and Southern Tablelands by the Chemistry Branch, Rydalmere, has indicated that considerable potential exists for improving the efficient use of superphosphate.

A soil survey project commenced in 1974–5 and has continued aimed at monitoring soil phosphate levels on approximately sixty sites based on 5 soil types throughout the area.

The promotion of the soil testing service of the Department has resulted in 116 individual soil tests being handled in 1976–7 for the Orange agronomy district compared with 26 tests in 1975–6—an increase of 346 per cent. In addition it is apparent that farmers have a greater awareness of the limitations of soil testing and of the way that it can be used to advantage.

This work has led to the development of the “Super Sense” project involving the two district Agronomists, the district livestock officer (Sheep and Wool), Bathurst and representatives of Australian Fertilizers Limited. Large-scale trials based on the

New England "Bloat-Safe" demonstrations are to be established on four properties in the Oberon area. These sites will involve 20 to 30 ha areas on each site. Five normal meetings, fourteen small informal meetings with graziers involved and six property inspections to select sites have been undertaken by officers involved in the project.

Co-operation has been obtained from Australian Wire Industries who will donate a substantial quantity of fencing material for trials subdivision.

Hydatids

During 1975-6, regional officers in association with the district veterinary officer, veterinary inspector, Carcoar Pastures Protection Board, the Community Health Sister, Lyndhurst Shire Council, and the Central Western Regional Advisory Council, combined to develop an hydatid awareness and eradication campaign in the Lyndhurst Shire.

Activities undertaken in 1976-7 were:

Dog testing. A total of 328 dogs were brought to dog testing sites throughout the shire. Of the dogs purged, 8.3% had hydatid tape worms. This was considered a high figure in view of the fact that only the more enlightened farmers brought dogs for testing.

School Programmes. In all 1 500 schoolchildren were contacted and provided with lectures by the veterinary officers: 253 infant level children entered the colouring competition: 72 primary schoolchildren entered the poster competition and 51 entered the crossword competition: 50 parents attended a prize-giving function for these competitions where prizes were presented by Bayer Australia Limited, the Central Western Regional Advisory Council and the Health Commission.

Other educational programmes were developed in a number of districts throughout the State. In particular the district veterinary officers at Goulburn and Homebush report major extension effort in contacting owners of cattle in which hydatidosis and cysticercosis were detected at slaughter by the State Meat Inspection Service.

Australian National Field Days Exhibit

The Department of Agriculture has been closely associated with the National Field Days since their inception. However, the increased effort and expertise put into commercial exhibits and other government and semi-government exhibits in recent years contrasted with the Department of Agriculture's effort.

Central Western Region was aware of the adverse image created by the lack of support by the Department as a whole for the exhibit and decided to increase efforts to improve the exhibit and obtain greater backing.

The efforts of the organizing committee produced a high standard of exhibit at the field days and demonstrated to the Department the necessity for increased support.

Features of the exhibit were: National Pig Carcass Measurement Service involving Wollongbar Agricultural Research Centre, the Victorian Department of Agriculture and district livestock officers; Methane Digester and methane gas production organized by Agricultural Mechanization Officer, Lismore supported by A.M.O.s and Agricultural Engineering Centre, Glenfield; weeds display organized by field officer (Weeds) featuring Department of Local Government's portable display unit; packaging and fruit quality control organized by Division of Horticulture officers and Commonwealth Department of Health plant quarantine exhibit; vegetable fault in wool prepared and staffed by Trangie Agricultural Research Station; rabbit control investigations prepared and staffed by Condobolin Agricultural Research Station; Commonwealth Department of Overseas Trade Information and Enquiry stand. General Enquiry and Publication Distribution Centre.

Significant statistics were: Pig Section—Between 500 to 600 enquiries handled; Sale Publications—increased by 211 per cent over 1975 figure; Trangie A.R.C.—700 booklets distributed; Mechanization Section—200 general mechanization enquiries plus 80 requests for pamphlets not at site; 2 000 methane gas and 2 000 electric fencing booklets distributed to *bono fide* enquirers.

Head Office personnel inspected the exhibit and as a result the Department's complete involvement and support has been forthcoming for this field day and similar major field days throughout the State.

Carpet Wool Production

A group of Central Tablelands producers has been assessing the feasibility of carpet wool production as an alternate enterprise on their properties. Several producers have visited New Zealand and rams have been imported and extensive trials conducted.

Australia imports its specialized wool for carpet production and the avenue exists for establishment of a local industry.

The officers involved in the project underwent a study tour of relevant production marketing and research establishments in Sydney and of carpet wool production in Victoria and Tasmania.

A full scale research programme has been developed in conjunction with the livestock research officer to evaluate these sheep.

An indication of the interest within the area is that 5 000 ewes, principally Romney Marsh, will be mated to Tukidale rams at the present mating.

A marketing association and a breed association are expected to be formed by interested breeders in this area during the next 12 months.

DISTRICT OBJECTIVES

In recent years there has been an increasing trend for district officers located in the one country office to co-ordinate their programmes where they have overlapping responsibility to their farmer clients. Co-ordination takes place informally as officers see the need, encouraged by Regional Directors of Extension and other officers with regional responsibilities.

Some examples of extension officers of different disciplines combining their efforts in one district are reported.

Ill-thrift in Coastal Cattle

During the expansion of the beef industry in the early 1970's much land close to the coast was brought into beef production. This land was previously considered marginal and required heavy fertilization to establish and maintain improved pastures.

With the fall in beef prices and the need to economize, the problem of general illthrift in coastal cattle became accentuated. The livestock officer (beef cattle) and the district agronomist have co-operated in a series of trials on a large holding and are involving the district veterinary officer and the Veterinary Research Station at Glenfield in the programme. Results from the trials should provide a sound backing for future extension activities in the area.

Least Cost Pig Rations

Most pig producers find that the number of calculations and information required rarely enables them to look beyond the major ration components of energy, crude protein and sometimes fibre levels. However, research and experience in pig nutrition have shown that several minerals and vitamins have an important effect on growth rate and carcase quality and are likely to be limiting in pig rations. The livestock officer (pigs) and regional economist have combined efforts to work out and test a computer programme designed to provide pig producers in the South West Region with a regular listing of least-cost rations for five different pig feed operations.

Dairy Production—Lismore

This group examined the dairy industry, the problem of urban spread into rural areas, the question of specialized versus generalized extension and its knowledge of the functions of other departments and the characteristics of prospective farm purchasers.

It was agreed that a booklet should be produced giving information about the local rural scene and aims specifically at prospective farm purchasers. This publication will cover the many pitfalls encountered in rural properties in this area.

Taree—Small Producers

This group determined that there is a need to find which producers need help in the present situation, determine what help they need and advise on means of contact. Approximately half the properties in the area are non commercial growers with incomes of less than \$2,000. This team also is developing a programme aimed at providing information for small producers. The concept will be a "mini care management" booklet designed to give people information about technology which can be adopted by them and applied on small properties. At the same time a programme will be developed to provide adjustment information to those people who wish to leave their farm.

Pasture Improvement/Stocking Rates

There has been a progressive decline in the area of improved pasture in the Dubbo district since 1970. At the same time stocking rates (due mainly to cattle) have increased by about 40 per cent over the same period.

It has been shown that lucerne, sub-clover and phalaris will successfully establish on both fertile and poorer type granite soils in the area. A major field trial to demonstrate required technology to evaluate species and management has been in

progress for 4 years. The trial has averaged a stocking rate of 8.75 d.s.e.'s per hectare over the 4 years. This represents an increase of 7- to 8-fold compared to natural pasture carrying levels.

Wool production per head and per hectare has been well above the district average. Gross margin returns of \$100 per hectare were achieved during 1976.

Strong liaison and co-operation with U.F.W.A. and the Agricultural Bureau has developed from this project.

Rangeland Management in Arid Zones

The Western Division of New South Wales is arid or semi-arid rangeland supporting a pastoral industry based on wool production with an increasing component of beef in recent years. The area has a history of grazing exploitation extending over almost 100 years. Droughts, overstocking and managerial practice have progressively depleted or changed the vegetative habitat with a resultant decline in productivity.

District livestock officer (sheep and wool), Bourke has submitted proposals for the establishment of a demonstration area involving a system of deferred grazing of sheep, cattle and goats. Communication outlets to increase contact between pastoralists and the Department's Extension Service are being co-ordinated. A newsletter for Western Division graziers has been approved by Publications Advisory Committee—the first issue was circulated to all Western Division pastoralists in April, 1977.

A programme of co-ordination of all extension resources operative in the Western Division is being developed through the Interdepartmental Rural Adjustment Committee. Western Lands Commission, soil conservation and pastures protection boards, Technical and Further Education are involved in the communication project.

INDIVIDUAL OFFICER OBJECTIVES

The majority of extension programmes encompass objectives which include practices which are on-going. With the more stringent farm economic situation, extension officers are now selecting more objectives aimed at aiding farmers to meet the problems posed by inflation costs and returns from export markets.

A very brief selection of individual officer's objectives is reported.

Solids-Not-Fat Levels in Milk

With the raising of standards required by the Dairy Industry Authority, dairy officers anticipated that many dairyfarmers would have difficulty in avoiding having milk rejected.

The livestock officer (dairy cattle) at Muswellbrook tackled the problem in two ways, realizing that two separate issues were involved. They were that farmers needed to know more about the principles and relationships involved and that officers needed to know more about the composition of feeds available to dairy cows in the district.

In the belief that farmers are not prepared to read a long treatise on the subject he prepared the essential information in the form of a single page pamphlet. This was edited and printed by the regional publicity officer on an offset duplicator and distributed to dairyfarmers.

At the same time, the livestock officer (dairy cattle) arranged for a regular analysis of grain and forages available to dairy herds. This was carried out over an extended period because of the seasonal nature of the S.N.F. problem.

The pamphlet too has been widely accepted and officers report that the problem is less serious than before standards were raised.

Irrigated Wheat

There is a need to develop and promote irrigation rotation cropping systems to maintain long-term productivity. There is very little knowledge of the management requirements of irrigated wheat as it is a new crop in the north-west of the State. The wheat crop contributes to the disease control and economic efficiency of associated crops in the rotation.

Although statistical proof is not available, yield levels have improved, crop management has improved and this is partly due to extension effort. Yield levels remain far too low and there is large scope for variety improvement.

Honey Production

There is little information on working bees in arid and semiarid areas, protein content of pollen-producing flora, bee strains for hot arid regions of the State and artificial insemination techniques in bee breeding.

Samples of Western Division flora and pollen have been collected and analysed in conjunction with samples of adult bees working the various flora. This work is being carried out with the assistance of Laws College, Queensland. Evidence suggests that a close correlation between pollen used by the bees and their body protein content. This factor is also tied in with working ability under adverse conditions.

Artificial insemination work was carried out to gain expertise in using specialized equipment. While insemination proved successful in producing offspring, the progeny hardiness and ability to survive is much lower than those naturally bred.

Weed Control in Cereals

Severe yield reductions are caused by weed infestations in the Cowra agronomy district. Dockages reduce income from contaminated grain and can result in the rejection of the crop.

An intensive extension campaign was mounted in the Cowra district by the district agronomist and the use of "Treflan" herbicide has resulted in dramatic results in the control of ryegrass. In the 1976 season, 60 per cent of the area sown to wheat was treated with herbicide.

It is estimated that an increase in yield of 10 to 15 per cent has resulted.

4.3 OTHER EXTENSION ACTIVITIES

AD HOC AND SPECIAL ACTIVITIES

Rural Adjustment. Extension officers in the North Coast region are faced with a difficult task in trying to motivate and help farmers, the majority of whom generate incomes little above the poverty level.

Officers involved have recognized the need for and adapted their extension away from traditional production extension to extension activities which relate more to the adjustment and survival situation of their clients.

Plague Locusts. Plague locust outbreaks during the summer months 1976-7 were widespread throughout the western region. Regional officers were seconded for periods of up to eight weeks to assist with the co-ordination of information and publicity from control bases.

Drought. The winter drought in southern New South Wales of 1976 was the worst on record, and could not have come at a worse time. Due to low cattle prices and expanded crop areas, graziers were heavily overstocked with very small fodder reserves.

The Department's officers responded quickly to the situation and a total of 31 field days/meetings were held, attended by more than 1 000 producers to discuss drought strategies and feeding options.

Floods. In March, farmers in the Lower Hunter experienced the biggest flood since 1955. Thousands of hectares of pastures, fodder crops and vegetable crops were inundated. Winter feed supplies for dairy herds were either wiped out or sowing of pastures and crops delayed by the waterlogging of the soil. Losses of vegetable crops were heavy and new sowings prevented by prolonged wet conditions.

District extension officers responded quickly to the need to give advice on feed strategies and herd management to the many dairy farmers affected. Loss of production and the second loss of seed and fertilizer in a smaller subsequent flood a few weeks later caused financial hardship.

The Central Coast area has over the past year, experienced two major floods. This has created a good deal of work in investigating claims by share and tenant farmers for flood relief assistance. These floods created severe feed shortages which resulted in the lowering of the solids-not-fat content of milk due to the lower plane of nutrition.

Flooding on the Namoi and Gwydir river systems in early 1977 resulted in officers at Gunnedah, Narrabri and Moree being involved in State Emergency Service duties.

Marketing Advice. Most commodity prices are collected on a daily basis by the Division of Marketing and Economics. Price information for agricultural commodities is made available to the public and disseminated through mass media outlets.

Royal Easter Show Award. The Department's display, designed and arranged by the Royal Botanic Gardens with some assistance from Division of Extension Services, received the first prize and shield for the best display by a government or semi-government organization. It showed how indoor plants could be displayed, and how they should be looked after in the home.

LIAISON

Officers continued to work with other personnel in allied fields to assist clients in obtaining the most appropriate information for their needs.

Some examples are reported from the wide range of liaison activities.

Extension/Inter-State

Much closer liaison now occurs between this and the Victorian Department of Agriculture to the greater advantage of farmers along the State border. A number of exchange visits by officers of both Departments have taken place to observe practices and to discuss problems of mutual interest.

A close relationship has been developed by the District Horticulturist (Vegetables) at Murwillumbah with appropriate staff members of the Queensland Department of Primary Industry.

Extension/Education

Close liaison is maintained with the principal and staff of the C. B. Alexander Agricultural College at Tocal. The Regional Extension Officer, Maitland is a member of the Curriculum Advisory Committee. He is also a member of the Graduate Diploma in Extension course at Hawkesbury Agricultural College.

The Regional Director of Extension, Maitland is a member of the Board of Studies for Certificate Agricultural Colleges.

Liaison with the Community Programmes Department of the University of Newcastle resulted in a one-day conference at Tocal on educational opportunities for rural people.

Agricultural Workshops, Tenterfield. Sponsored by Tenterfield High School in co-operation with departmental officers, very successful workshops were conducted for high school children from a number of schools in New England and other regions. A feature was the active participation of Tenterfield district producers in learning activities.

Extension/Research

Decide Workshops. Involved people from the Department, CSIRO, University of New England and agribusiness. They were designed to familiarize research and extension workers with the application of the "decide" method for determining economic superphosphate rates for pastures and crops. The second workshop placed emphasis on case studies which resulted in a simplification of the theory and an acceptance that accurate base data was essential for the successful use of the model in individual situations.

Extension staff have become increasingly involved with the selection of research priorities and the planning of research work. Staff from all divisions have been involved in various conferences and workshops dealing with local research priorities.

For example, following inspections of field trials established by Department of Agriculture and CSIRO research workers in the Canberra-Yass area, officers met to discuss agronomy research needs and a statement on these needs was subsequently prepared and issued to all concerned.

An example of co-operative effort has been the initiation this year of a co-ordinated applied research and extension programme for regional cropping trials. This has involved the standardizing of varieties, techniques, sites and measurements. Trangie Research Station is also assisting with computing facilities for statistical analysis. A mobile unit for transporting machinery and equipment to trial sites and a technical assistant to help with the programme has been provided for from A.E.S.G. funds.

Extension/Industry

Liaison with commercial firms is continuous as a result of the very wide range of crops grown and livestock attracting representatives of all the agricultural business companies.

Joint meetings were held at a number of localities to review and revise recommendations and to exchange information on product usage and technology.

Representatives of five different rural industry agencies attended meetings with extension staff at Goulburn and subsequently assisted in the organization and staging of a major machinery field day in November, 1976.

The success of that field day led to the development of more ambitious plans for a field day in spring 1977 involving field trials with crops, etc., as well as machinery.

Australian Fertilizers Ltd organized an inspection of pasture grazing evaluation demonstrations on the Northern Tablelands for a party of four agronomists and one livestock officer from the South East and Illawarra Region.

Sheep Training Schools. These two schools involved sheep handling and selection, fleece measurement, stud selection and lamb drafting for market requirements. Since these courses commenced in 1975 a total of fifty-two staff of Elder Smith Goldsbrough Mort Ltd have participated. These courses have been extremely successful and have facilitated closer liaison and understanding between the stock agency trade and the Department.

SUMMARY OF INDIVIDUAL AND GROUP EXTENSION ACTIVITIES

(i) <i>Farmers Visited</i>						
<i>No. of Visits</i>						
1 Visit	..	..	..	..	..	9 310
2 Visits	..	..	..	..	..	3 105
3 Visits	..	..	..	..	..	1 230
4 or more visits	..	..	..	..	..	2 081
At least one visit	..	..	..	..	..	15 726
Property visits by veterinarians	..	..	..	..	..	14 653
(ii) <i>Group Extension (Excluding Rural Youth)</i>						
Field Days	..	..	..	..	825	Attendance 27 125
Meetings	..	..	..	..	1 310	26 775
Conferences, Schools and Courses	..	..	..	..	168	4 297
(iii) <i>Rural Youth</i>						
Number of Rural Youth Clubs	..	..	..	..	..	202
Number of meetings, field days, schools, etc.	..	..	..	..	..	3 148
Total attendance at educational functions	..	..	..	..	..	35 534
Total attendance at social functions	..	..	..	..	..	13 788
Total attendance at organizational functions	..	..	..	..	..	18 593
Total farm or home visits by Rural Youth Officers	..	..	..	..	..	3 498

SUMMARY OF MASS MEDIA OUTPUT

Articles for <i>Agricultural Gazette</i>	..	..	..	..	58
Articles for <i>Dairy Topics</i>	..	..	..	..	30
Articles for statewide journals and magazines	..	..	..	..	231
Press Articles	..	..	..	..	3 214
Radio Broadcasts	..	..	..	..	3 811
Television	..	..	..	..	109
Issues of Regional or District Newsletters	..	..	..	..	273
Contributions to Research/Extension Liaison	..	..	..	..	..
Conferences	..	..	..	..	72
Joint Papers with Research Workers	..	..	..	..	8
Regional or Local Bulletins or Pamphlets	..	..	..	..	451
Extension Forum Articles	..	..	..	..	41

Installation of line recording facilities at regional extension offices has increased the capacity to obtain radio penetration through voice inserts in news and similar type programmes.

A new Western Division Programme is now being compiled by Bourke and Cobar officers for play over 2CR's Byrock repeater 2BY in place of part of Monday's ABC Rural Programme. A cassette recorder and professional standard microphone have been located at Bourke for use in putting together this material. The actual programme will commence in August, 1977.

The South West Region reports that editors of newspapers are inclined to publish fewer press articles and are not as agreeable to publish columns as in the past.

Only one-fifth of the newspapers through which news is circulated in the mid-coast and Hunter region can be regarded as country papers; the rest are in city or near city areas. Among these are six major ethnic newspapers to which news is printed to cater for the increasing number of full or part-time migrant farmers.

Because of this urban influence on mass media officers have developed newsletters to get agricultural extension information direct to farmers.

A strong demand continues for *Pasture and Crop Sowing Guides* now compiled by each of the four District Agronomists in the mid-coast and Hunter region. A total 7 800 of these guides was published during the year for spring/summer and autumn/winter sowings. The folded, single sheet form is welcomed by farmers and seed merchants alike. Because of its form it is comparatively simple to keep it up to date and reprint it for each season.

PUBLICATIONS

Editorial Section continued their functions as outlined in section 2.1. The following were fully processed editorially, and put through all production stages to final publication: 97 information bulletins; 52 miscellaneous jobs; *Agricultural Gazette*, 6 issues (printing run now almost 20 000); *Dairy Topics*, 4 issues; *Poultry Notes*, 4 issues; some 100 *Gazette* article reprints, and 37 news releases. In addition, requisitions for two technical bulletins, one *AGBulletin* and three issues of *Extension Forum* were put through.

Rationalization of bulletins has reached the stage where new titles and revised editions are numbered according to their logical place in a categorized list of titles. Storage and retrieval of information will thereby be standardized and simplified.

HOME GARDEN INQUIRIES

Total inquiries for the past years were—

1973-4	..	..	..	..	..	..	12 990
1974-5	..	..	..	..	..	..	16 692
1975-6	..	..	..	..	..	..	16 412

Inquiries for the current years were as follows—

Telephone	..	..	..	..	..	..	13 197
Postal	..	..	..	..	..	..	830
In-Person	..	..	..	..	..	..	2 531
Field Officers	..	..	..	..	..	..	200

16 738

The two officers presented fourteen lectures to garden clubs, horticultural societies and agricultural bureaux, and visited gardens and nurseries in the metropolitan area. They also revised some existing publications, contributed articles to the *Agricultural Gazette* and prepared material for departmental bulletins.

5. EDUCATION

The Department of Agriculture continued to administer three agricultural colleges—a College of Advanced Education at Orange (Orange Agricultural College) and two Certificate Colleges, one at Paterson (C. B. Alexander Agricultural College) and the other at Yanco (Yanco Agricultural College). The colleges provide training, both in the practical and theoretical aspects of agriculture, to those aspiring to establish themselves in careers on the land or in related service industries.

During 1976–77, the education centre at the Royal Botanic Gardens provided guided tours for 5 941 tertiary, secondary and primary students. In addition, 4 962 students requested tours which could not be provided because the centre is heavily booked in advance. Many of these students were provided with maps and information which enabled their own teachers to guide the tours.

Botany and photography students at a tertiary level, and teacher trainees (pre-school, primary and secondary) made extensive use of the education service. The six botanically-orientated topics were in great demand by secondary students, and the ten topics of a more general nature were particularly frequently used by primary schools. Any specific topic which is appropriate to the Royal Botanic Gardens is prepared upon teacher request, and ten such topics were prepared and used during the year.

Reference material and assistance were provided for 190 wide ranging inquiries from students completing projects and teachers developing study units.

As the education centre is open to the public when classes are not in progress, a variety of displays were prepared, and three new self-guided tour leaflets were completed. The botanical staff, as well as the Education Officer, were involved in the preparation of such material.

The education service at the Royal Botanic Gardens recognizes that education is a continuing process which does not terminate on the completion of schooling. Because of this, emphasis is placed on the preparation of information leaflets for adults, as well as the provision of guided tours and assistance to teachers and students.

NEW ADMINISTRATIVE ARRANGEMENTS

Investigations in respect of self-government at Orange Agricultural College continued during the year.

EDUCATIONAL RESEARCH

The survey into the further education needs in agriculture in the Hunter Valley and Northern Tablelands areas of the State, which was funded by a research and development grant of \$14,000 received from the Technical and Further Education Commission, Canberra, in conjunction with the New South Wales Department of Agriculture and administered by the C. B. Alexander Agricultural College, has been completed. The results of the survey were published in a booklet entitled "Lifelong Education for Practising Farmers" in April, 1977.

The Senior Research Officer (Education) who is located with the Agricultural Education Secretariat, prepared the following submissions and reports during 1976–77.

- Training for future farmers—A Survey of Opinions of New South Wales Farmers on a Proposal for an Agricultural Training Scheme.
- A Profile of Students in Certificate-Level Agricultural Colleges of New South Wales.
- Some Characteristics of Agricultural High School Students (Report to N.S.W. Department of Education).
- Sex Differentiation among Students in New South Wales Country Secondary Schools (Submission to N.S.W. Department of Education Working Party).
- Post-Secondary Training Needs of Students in the Orana and New England Regions (Submission to Committee on Community Colleges).

(The above reports were based on data compiled from two large-scale questionnaire surveys of farmers and students carried out in 1975–76.)

- Submission to the Commonwealth Committee of Inquiry into Education and Training.
- Interim Report—Survey of Students Enrolled in Stage I of Agricultural Courses at N.S.W. Agricultural Colleges, 1977.

In addition, a questionnaire survey was conducted of participants in two further education programmes conducted at Yanco and C. B. Alexander Agricultural Colleges and a report is in preparation.

CAPITAL WORKS PROGRAMMES

As the majority of projects being undertaken with funds provided under the States' Grants (Advanced Education) Act and the States' Grants (Technical Training) Act have been completed, expenditure decreased from \$1,001,244 in 1975-76 to \$267,307 in 1976-77.

The total value of projects completed or nearly completed at the agricultural colleges was almost \$3,800,000. Major works comprised: food technology buildings, plant science building and field service unit at Hawkesbury Agricultural College, student accommodation, mechanic's workshop and stores building at Orange Agricultural College, animal and plant science laboratories, and extensions to the engineering building at Wagga Agricultural College, teaching complex at C. B. Alexander Agricultural College.

Even though Hawkesbury Agricultural College has become a corporate institution, and Wagga Agricultural College has been incorporated with the Riverina College of Advanced Education, the Department is responsible for the winding up of projects included in the 1973-75 Advanced Education programme.

N.S.W. INSTITUTE OF RURAL STUDIES

The Institute has met on three occasions since 1st July, 1976, and has reiterated two of its most important guiding principles.

The first is that its overall long-term aim must be to provide as complete a range as possible of post-secondary agricultural education at levels appropriate to the particular stage at which formal secondary education is terminated.

The second concerns flexibility; that is, so far as vocationally orientated courses of training are concerned, entry qualifications should be sufficiently pliable not to depend exclusively on the results of any single public examination, but should give due regard to such important considerations as vocational interests, motivation and prior industry experience.

The Institute is aware of a continuum at the post-secondary level which includes certificate-level colleges, colleges of advanced education and universities, and sees the need for ease of transfer of students between these three parts of the continuum. Investigations into ways of facilitating this mobility of students are proceeding.

Relationships with other organizations

(a) The N.S.W. Higher Education Board

The Institute has continued to maintain contact with the newly constituted Board, to ensure, among other things, the development of a balanced system of agricultural education in the State and a co-ordinated approach in the use of available resources in accordance with community needs.

The Board looks to the Institute as a body able to provide it with information, comments and advice on a range of matters associated with advanced education courses in the area of rural studies. An important development in this regard is the Board's statement in November, 1976, that it would be prepared to consider for inclusion on its assessment committees for courses in agriculture a person nominated upon invitation by the Institute.

(b) Hawkesbury Agricultural College

The College was declared an affiliated College of the Institute on 5th August, 1976.

Board of Studies for Certificate Agricultural Colleges

The Board has continued to play an integral role in reviewing and advising on existing and proposed courses offered by C. B. Alexander and Yanco Agricultural Colleges, to ensure that programmes of study reflect educational standards appropriate to the vocational areas which they are designed to serve. In the discharge of these functions, the Board maintains close liaison with the course advisory committees at each college, and each year visits the colleges to meet students and staff members.

Notable developments arising from the Board's investigations and recommendations include the introduction, in 1977, of a course in pastoral zone management at Yanco College; the examination of student progression within a tiered system of agricultural education at the certificate-level colleges, colleges of advanced education, and universities; and the re-structuring of advanced courses at Yanco College in 1977 involving compulsory core subjects, optional elective subjects and production subjects.

Resource Committee on Agricultural Education for School Leavers and Practising Farmers

(a) Report on an Agricultural Training Scheme in New South Wales

Following a report by the Committee on a proposal for an agricultural training scheme in New South Wales, the Institute resolved that, on the basis of the Committee's investigations and in the light of unanimous advice from producer organizations, the only acceptable format at present for an agricultural training scheme appeared to be cadetship.

Negotiations are now in progress between the State and Federal Governments concerning possible financial support for such a scheme.

(b) Orana Rural Training Committee

The Committee continued in its active role of developing courses with a practical bias towards the requirements of producers in the region. Courses have been held in a variety of subjects ranging from farm office management to welding and header maintenance.

Planning Committee for Orange Agricultural College

The Committee is aware that the Commission on Advanced Education looks to the Higher Education Board for advice on the long-term proposals of Orange College "consistent with the rational development of post-secondary education in the State" (Commission's Report, 1977-79). For this reason, the Committee perceives the need for close contact with the Board so as to guide the College's contribution to a vigorous and well-balanced programme of farm management education.

The College's development is seen as being towards a multi-level institution concerned with agricultural and related studies and making provision for meeting the needs of the rural community.

No less importantly, in the longer term, the development of a community college on the present foundation might be considered as an approach to meeting the needs of future post-school education in the Bathurst-Orange region.

Standing Committee of Agricultural College Principals

The Committee was established as a means whereby the Principals of Agricultural Colleges in New South Wales can formulate advice to the Institute on a variety of issues ranging from the problems and needs of agricultural colleges to developing relations with other countries with respect to agricultural education matters.

The Committee has under consideration at present a possible rationalization of course assessment procedures at the advanced education level in the field of rural studies and a co-ordinated programme for the determination of the levels of such courses and the funding thereof.

It is noteworthy and encouraging that the Principals of both corporate agricultural colleges, Hawkesbury and Wagga (the latter within Riverina College of Advanced Education), have been enthusiastic participants in the Committee's deliberations thus far.

National Workshop on the Function and Management of the Institutional Farm as an Educational Resource

The Workshop was held at Hawkesbury Agricultural College on 9th-11th May, 1977, and involved some 65 participants.

The major recommendation incorporated the need for institutions with farms attached to dissect the cost of farm operations from other academic expenses and the observation that such farms should not necessarily be expected to run at a profit.

The Institute will be responsible for advising agricultural establishments on appropriate accounting procedures to dissect farm income and expenditure from other academic costs.

COLLEGES OF ADVANCED EDUCATION

The comments in this section refer to Orange Agricultural College, which is the only College of Advanced Education now administered by the Department.

COURSES

A new course titled "Associate Diploma in Farm Secretarial Studies" commenced in February, 1977. The aim of this course is to provide students with a thorough training in the techniques and business recording aspects of farm production, which will enable them to become proficient farm secretaries.

A committee has been selected to assess a proposed one year Horse Certificate Course. Details of the course have been submitted to the Higher Education Board for approval.

The commencing date of the Farm Management course at Orange Agricultural College was altered in 1977. Students were previously accepted in this course in August each year, however, from 1977 new enrolments in all courses will be taken at the commencement of the Autumn Semester.

All 33 students who sat for the Associate Diploma in Farm Management final examination were successful in gaining their diplomas.

STUDENT ENROLMENTS

There were two intakes of Farm Management students due to the alteration of the commencement date: 56 students enrolled in August, 1976, and 40 enrolled in February, 1977, making a total of 96 new students—an overall increase of 35 over last year's enrolments.

Thirty-one students enrolled in the new Associate Diploma in Farm Secretarial Studies course.

SHORT TERM SCHOOLS

The facilities at the college were used during vacation periods to conduct short term schools and workshops, mainly for rural groups, industry organizations and departmental officers.

FARM SECTION

Two policy changes were made in 1976-77. It was decided not to replace the crossbred vealer raising herd which was due to be cast for age, and the merino ewe flock was reduced so that 300 crossbred ewes could be purchased for educational purposes.

Over the 12 months period, the beef cattle herd consisted of 123 hereford steers and 21 hereford cows, 33 crossbred vealers, 53 crossbred cows and 8 bulls. A bull was transferred to Tocal and 40 steers were purchased. Natural increases for the year were 137 hereford and 48 crossbred.

A further 4 rams were purchased for the merino flock from Hazeldean Pastoral Company at Cooma. During the period 571 ewes, 120 hoggets, 180 wether weaners and 84 mixed aged culls were sold. Natural increases were 503. An extremely severe week of snow and sleet was experienced during the peak of lambing. The College sold 6 398 kg of wool during the year.

Three hundred crossbred ewes comprising: 80—6 years old, 100—3 years old and 120 rising one year, were purchased. The spread of age was chosen to give comparison of production. Six Dorset Horn rams were purchased from the Agricultural Research Station Cowra.

Fodder comprised 200 tonnes of silage, 200 econ fodder rolls, 2 658 bales of hay.

CERTIFICATE COLLEGES

COURSES

There were three courses conducted at Yanco Agricultural College during 1976, viz.: Certificate in Agriculture, Advanced Certificate in Irrigation, and Advanced Certificate in Animal Production.

From the commencement of the 1977 academic year, the Advanced Certificate in Animal Production course has been broadened to include optional subjects in animal and crop production, and has been redesignated as the Advanced Certificate in Agriculture.

A new course titled "Advanced Certificate in Pastoral Zone Management" was introduced in February, 1977. The course is designed to cater for the needs of the young men and women who will be involved in property management in the western pastoral zones, and deals with the particular problems of the pastoral zone. Emphasis is placed on the understanding of the environment and ecology of semi-arid areas.

Two courses were conducted at C. B. Alexander Agricultural College, viz.: Certificate in Agriculture, and Advanced Certificate in Agriculture.

Certificate in Agriculture. In this discipline 54 students sat for the final examination at Yanco with 48 being successful, whilst at C. B. Alexander, 56, out of the 58 who attempted the final examination, were successful.

Advanced Certificate in Irrigation. All of the 4 students who sat for the final examination were successful.

Advanced Certificate in Animal Production. 3 students sat for the final examination, and all were successful.

Advanced Certificate in Agriculture. Out of the 45 students who attempted the final examination, 38 passed.

STUDENT ENROLMENTS

With the exception of the new Pastoral Zone Management course at Yanco, 202 students enrolled at the two colleges in 1977, an increase over the 194 who enrolled in the five courses in 1976. Three students enrolled in the Pastoral Zone Management course, so that the total enrolment for 1977 was 205.

Enrolments in the Certificate in Agriculture course at Yanco increased from 69 in 1976 to 71 in 1977. Those in the Advanced Certificate in Irrigation increased from 4 to 11, and 13 students enrolled in the redesignated Advanced Certificate in Agriculture course, which was an increase on the 5 who enrolled in the old Advanced Certificate in Animal Production in 1976.

At C. B. Alexander, a record number of 72 students enrolled in the Certificate in Agriculture course in 1977, an increase over the 1976 enrolment of 67; however, enrolments in the Advanced Certificate in Agriculture fell from 49 in 1976 to 35 in 1977.

ASSISTED STUDENTS

Many students at both colleges received monetary allowances from the Commonwealth Tertiary Education Assistance Scheme, and some received assistance from the Soldiers' Children Education Board. Also, one student at C. B. Alexander was assisted by the Aboriginal Grants Scheme.

The United Farmers and Woolgrowers Association who usually sponsor a student each year at one of the colleges, did not award their scholarship in 1977, due to the unsuitability of the applicants.

FARM SECTION

At Yanco Agricultural College the beef cattle numbers decreased from 190 in 1975-76 to 175 in 1976-77. Dairy cattle increased from 145 to 152, and milk sales decreased from 207 415 litres to 204 699 litres.

Other livestock statistics are: pigs increased from 60 to 102, sheep decreased from 1 188 to 1 038, and horses remained the same at 6.

The barley crop yielded 6 tonnes of grain and a total of 10 050 bales of hay, comprising 2 060 bales of pastures, 7 540 bales of cereals, and 450 bales of lucerne, were produced. The wool clip was 4 217 kg.

The horse herd at C. B. Alexander increased from 35 in 1975-76 to 44 in 1976-77, beef cattle decreased from 1 486 to 1 370, dairy cattle decreased from 287 to 270, sheep decreased from 118 to 108, and goats remained the same at 5.

Twelve Australian Milking Zebu heifers were received at the College from the C.S.I.R.O. to contribute to the Department's project to build up more information on the AMZ breed.

Farm production figures were: milk 427 186 litres, silage 250 tonnes, and hay conserved 12 029 bales.

6.1 REGULATORY AND TECHNICAL SERVICES

PLANT DISEASES ACT

Amendments and New Regulations, Proclamations, Orders and Notifications

Regular review of the Act and legislation under it has continued in an attempt to keep the legislation relevant to current requirements.

The Act: Although a draft of amendments to the Act covering penalties, the removal of ambiguities relating to powers of inspection, the control of pests in certain situations and provision to make certain regulations has been submitted to Parliamentary Counsel, there has been considerable delay in having the amendments placed on the legislative programme. Increased penalties proposed in the amendments are urgently required both to deter and reduce the need for repetitive prosecutions of certain individuals, particularly for quarantine type offences.

Regulations: New regulations gazetted were:

- A regulation revoking thirteen regulations either obsolete or made redundant by the introduction of ministerial orders, and revoking a further six forms.
- Regulation 48A—Packing and labelling rockmelons.

Progress has been made with the drafting of regulations for the grading and packing of bananas, pome fruits, tomatoes, pumpkins, lettuce, onions and carrots.

Proclamations: New and amending proclamations were gazetted for:

- Revoking proclamations previously issued for fruit fly, codling moth, tobacco blue mould, red scale, wheat rust, removal of fruit and treatment of boxes.
- Commencing of section 4 of the Plant Diseases Amendment Act to permit introduction of Ministerial Orders under section 5A.
- Prohibiting the introduction of seed potatoes into N.S.W.
- Requiring certification of freedom from Argentine ants of produce from Victoria.
- Permits to move citrus trees from the Gosford and Wyong Shires to other parts of the State.

Notifications: One notification was gazetted to remove the quarantine imposed on a citrus nursery at Lisarow for citrus red mite and another to impose the quarantine for this pest on the Gosford and Wyong Shires for citrus trees consigned outside the Counties of Cumberland and Northumberland.

Orders: Ministerial orders were published under section 5A of the Act for the first time. The orders generally updated the prescribed control measures for major pests and diseases and replaced regulations and proclamations previously used for this purpose. The orders have the same standing as a regulation with the additional benefit of being readily revised and republished as required. Orders were gazetted for fruit fly, codling moth, bunchy top and weevil borer of bananas, black end and squirter diseases of bananas, San Jose scale, tobacco blue mould and stem borer, tobacco beetle, tobacco mosaic, and citrus gall wasp.

Quarantine Areas

Banana bunchy top: The trend for bunchy top to decline in the Tweed River district continued during the season, but the situation in the Brunswick district deteriorated as a result of a serious outbreak in one section, possibly the result of too infrequent inspections. More drastic regulatory action was taken in these districts to have chronic areas of bunchy top removed from plantations. In addition, action has been taken under section 16 of the Act to have a number of weedy and unclean plantations destroyed where the occupiers have neglected to do so even after several prosecutions.

Number of Infected Plants

District	1972-73	1973-74	1974-75	1975-76	1976-77
Tweed	943	1 669	1 856	1 706	1 072
Brunswick	151	252	196	316	765
Richmond	5	2	..	..	..
	1 099	1 923	2 052	2 022	1 837

Banana weevil borer: In the Coffs Harbour district 74 hectares of bananas (twenty plantations) were found to be infested with weevil borer, *Cosmopolites sordidus*. A total of 400 hectares are now receiving treatment in the district. New areas found were in the northern districts near Bruxnor Park and further infestations occurred in the Korora Bay area. There has been no evidence of resistance to dieldrin in the Coffs Harbour district. No new infestations were recorded in the Macksville district. The importance of this pest in the Tweed/Brunswick district has declined over the past two years due largely to the effectiveness of the chemical chlordecone on the dieldrin resistant population.

Queensland fruit-fly (*Dacus tryoni*): Fruit-fly activity was a marked change to the serious problem of recent years, being lower than normal due largely to the hotter and drier summer conditions. These conditions assisted greatly in control in the M.I.A. quarantine area. Only one larval infestation was found at Cugel near Narrandera and a total of only nineteen flies trapped in the whole of the M.I.A. A total of 52 roadblocks and 25 road patrols were conducted on the M.I.A. resulting in 379 interceptions.

Five small outbreaks were detected in station homes along the Darling River in the Pooncarie area. The closest outbreak at Killeen Station was 64 km from commercial citrus producing areas of Sunraysia. Unless New Zealand is prepared to grant a dispensation below the 80 km radius of freedom from fruit-fly, ethylene dibromide (EDB) fumigations will again be necessary for the coming season's citrus exports. As a result of fruit-fly outbreaks the previous season, 205 EDB fumigations were supervised for all export citrus to New Zealand plus fruit shipped to South and Western Australian markets.

An inspector has been located at Broken Hill for a full season with a vehicle and spray equipment to apply regular bait sprays in a whole town treatment programme over the city. A total of thirteen bait sprays were applied to the town using 34 805 litres of bait. While eradication was not achieved in this first season of operation, the fruit-fly population was minimal by the end of the season. The programme was assisted by seasonal conditions together with campaigns to pull unwanted trees, regular collection and destruction of waste fruit by the council, backyard inspections and good co-operation by townspeople generally. It is important to eradicate fruit-fly from Broken Hill as it poses a direct and continuing threat to the fruit producing areas of Sunraysia.

Citrus red mite (*Panonychus citri*): This pest has now been recorded in most citrus growing districts near Gosford and in some backyards in Sydney. It has not been recorded in commercial citrus growing districts near Sydney or Windsor. Quarantine action has been taken to prevent this pest being transported on nursery stock to inland areas.

Citrus leaf miner (*Phyllocnistis citrella*): This pest has persisted in the Wyong/Warnervale districts and has continued to be a problem with nursery trees and in autumn growth of mature trees. It has not established in the main citrus growing districts near Gosford and its distribution as expected into the Sydney region has not occurred, indicating it may have reached the limit of its climatic adaptability.

Warehouse beetle (*Trogaderma variabile*): This exotic stored products pest was detected for the first time in a rice mill at Griffith. The premises were quarantined and a Consultative Committee on Exotic Pests under Standing Committee on Agriculture was formed to investigate the occurrence and recommend control measures and further action. Inspections of all rice storage sheds and mills revealed infestations also at Leeton, Coleambally and Deniliquin mills. Attention was then directed to storage premises, firms and farms which had taken delivery of rice by-products and further infestations were found at two central premises and on three farms. A major clean-up and control programme was initiated and a decision will soon be reached whether complete eradication is a possibility. Statewide inspections have not detected the pest in other areas.

Market Inspections

Pome fruit: There was no problem with internal breakdown in apples from the 1976 crop. Regulatory action was necessary for some new season fruit being either undersized or marketed before maturity dates. Supplies of this fruit reached near glut proportions during April when the smaller size fruit became virtually unsaleable. Bulk bin sales are increasing but buyers are insisting on the fruit being of one size in the bins. A total of 10 542 packages of apples were detained under section 18A. Of these 2 518 were from New South Wales, 6 690 from Queensland, 674 from Victoria, 96 from South Australia, 384 from Tasmania and 180 from Western Australia.

A large proportion of pears were small in size and difficult to sell. A total of 23 945 packages were detained under section 18A being 4 654 from New South Wales, 17 778 from Victoria, 1 334 from Queensland and 197 from South Australia.

Citrus: A total of 599 packages of lemons were detained under section 18A with 411 from New South Wales, 176 from South Australia and 12 from Queensland.

Bulk bin sales of Valencia oranges continued to increase. The 1977 navel orange crop has commenced and Queensland fruit easily passed maturity tests. New South Wales coastal navels were late in maturing with some lines rejected for immaturity. All told a total of 1 599 packages of Valencia and navel oranges were detained under section 18A comprising 643 from Victoria, 589 from South Australia, 308 from New South Wales and 60 from Queensland. In addition, 90 bulk bins were downgraded.

Injury from ethylene degreening was evident in some early season mandarins. A total of 1 314 packages were detained under section 18A being 499 from New South Wales and 815 from Queensland.

Some importations of grapefruit from California and Israel were of excellent quality and found ready sales. A total of 224 packages of grapefruit were downgraded under section 18A being 73 from New South Wales and 151 from Queensland.

Grapes: The first consignments were received from Charters Towers, Queensland, on 17th December, and readily passed maturity tests. Main season varieties from Queensland commenced on 29th December and sultanas from Menindee, New South Wales, on 17th January. A total of 596 packages of grapes were detained under section 18A for immaturity and 1 569 packages for labelling offences.

Tropical fruit: Avocades were well presented in trays. Papaws were of good quality with very little anthracnose blemish. Pineapples were generally of sound quality with bulk bins being used for transportation before repacking. Anthracnose blemish was a problem in some lines of mangoes, and fruit-fly was detected in some others. Importations of mangoes from India were of fair quality and met a variable demand. Bananas from northern New South Wales were adversely affected by cyclones and quality was variable due to the lightness of the crop. A total of 67 packages were detained under section 18A.

Berry fruit: Strawberries were generally of good quality, but topping was detected in some consignments and 211 trays were detained under section 18A for resorting.

Stone fruit: The incidence of fruit-fly infestation in stone fruits was negligible, as was brown rot.

Tomatoes: Inferior quality tomatoes were received from Victoria in late summer and many lines were downgraded causing losses to suppliers. A total of 16 223 packages were detained under section 18A, being 2 770 from New South Wales, 9 443 from Victoria, 2 973 from Queensland and 1 037 from South Australia.

Potatoes: Insect damage to potatoes was minimal and grading has improved over recent seasons. A total of 30 645 bags were detained under section 18A being 3 095 from New South Wales, 14 643 from Victoria, 10 036 from Queensland and 2 871 from South Australia. Bulk bins are being used extensively for sales to prepackers and processors.

Other vegetables: Castaway certificates were issued on 2 400 occasions for vegetables during the year.

General

The following summarizes activities (other than market inspections) under the Act during the year:

Inspections of—

Farms and orchards	10 169
Nurseries and resellers	5 332
Home gardens	38 626
Shops and merchants	4 622
Grain storages	1 640
Instructions	180
Notices served	373
Prosecution information prepared—	
Failure to control pest and disease	1
Breach of M.I.A. and Murray quarantine	28
Breach of Section 5A Order—Banana quarantine	46
Other	3
Prosecutions conducted	75

These statistics show a 12 per cent decline in inspections of farms and orchards and backyards which was indicative of the better pest and disease situation, particularly fruit-fly activity. Backyard complaints investigated declined to 89 from 154 the previous year. Conversely nursery and reseller inspections increased by 65 per cent because of

increased activity under the Horticultural Stock and Nurseries Act, and grain storage inspections increased by 205 per cent largely due to the outbreak of warehouse beetle in the M.I.A. and greater attention to grain pest control in other districts.

HORTICULTURAL STOCK AND NURSERIES ACT

The number of registered nurserymen and resellers has increased:

					1975-76	1976-77
Nurserymen	..	..	..	..	1 220	1 667
Resellers	..	..	..	..	1 420	1 761

Grants were approved by the Minister from the Horticultural Stock and Nurseries Account for the betterment of the nursery industry:

- \$1,500 for special research equipment required for Dr K. Baker, of U.S.A., whose visit to Australia to expand a programme on biological control of nursery pathogens had been supported by a previous grant from the account.
- \$4,000 to Mr R. J. Worrall, Research Horticulturist (Floriculture), to attend symposia in Dublin, Ireland, on the "Propagation and Raising of Nursery Stock" and the "Production of Protected Crops in Peat and Other Mediums".

A regulation has been drafted and is proceeding to prescribe the circumstances under which compensation may be paid when nursery stock is destroyed under instruction to prevent the establishment of a new pest or disease. A reserve of \$10,000 has been established in the Account for this purpose.

POTATO GROWERS' LICENSING ACT

Eighty per cent of the fees raised from licensing under this Act was made available by grant to the N.S.W. Potato Growers' Association as its sole source of income to use for the general benefit of the industry. A total of 986 licences were issued compared with 958 in 1975-6.

QUARANTINE ACT (COMMONWEALTH)

Administration

Plant quarantine is administered in New South Wales by the Division of Horticulture on behalf of the Commonwealth Department of Health. Specialist services are provided by the Divisions of Horticulture and Plant Industry, the Biological and Chemical Research Institute and the Royal Botanic Gardens. Technical assistance is also received from the Forestry Commission and the Australian Museum.

There was some recovery in general activity in both sea cargo and general passenger ships. Plant quarantine fees were not increased during the year, but the total collected was \$544,950 compared to \$485,300 the previous year.

The vehicle fleet at Export and Import Branch has been brought to full strength. The two-way radio communication system has been strengthened by the addition of eight "Mota Rola" walkie-talkie type handsets. The premises at the Branch are under reconstruction, with a new vehicle entry point being installed to allow traffic flow in a straight line beneath the building and to permit entry by all types of transports to the unloading dock. A second inspection bay has been approved and construction is expected to commence shortly. Until these works and the construction of the North Western Expressway are completed, movement of vehicles into the Branch will remain difficult. The Public Works Department has approved the installation of air-conditioning in the Branch which will considerably improve working conditions in the building. The quarantine treatment area at Port Kembla is nearing completion and will provide improved lock-up facilities for goods under treatment.

Plant Quarantine Station

A total of 3 586 plants and seed lines were received into post entry quarantine. These included:

Departmental and university seed introductions	..	..	846
Private seed introductions	..	..	21
Departmental fruit tree introductions	..	..	22
Other departmental introductions	..	..	35
Private plant introductions	..	..	2 662

Seed introductions by government departments and universities and plants imported on behalf of private individuals continued to increase.

Comparative figures for the past 4 years were:

					Departmental Seed Introductions	Private Plant Introductions
1973-4	..	..	..	..	326	1 477
1974-5	..	..	..	..	546	1 569
1975-6	..	..	..	..	772	2 054
1976-7	..	..	..	..	846	2 662

Plant pests recorded include:

- The nematode *Meloidogyne hapla* on plants of *Acalypha godseffiana* and *Pseudocranthemum* sp. ex-Singapore.
- A strong virus reaction from a peach variety, Sweeney, ex-California.
- Prunus virus symptoms from a rootstock, *Prunus fruticosa*, "PALL" ex-Germany.
- Vein yellows virus infection of a quince cultivar, C128, ex-U.K. (attempts are being made to free this cultivar of the virus).
- The virus disease Pelargonium Ring Spot on three varieties of Pelargonium imported from U.K.
- Potato virus Y (PVY) in one variety ex-U.S.A.
- A leaf spot infection in two plants in a consignment of orchids from Bangkok.

The following works were undertaken during the year:

- Alterations to the laboratory to provide for a preparation room and to the office to provide improved access to the laboratory area.
- Provision of an improved electrical supply to the acrylic glasshouse and garage workshop.
- Installation carried out by station staff included a glasshouse misting system and a Chino 12-point temperature recorder to provide accurate temperature monitoring to all glasshouses on the one graph.

Major items of plant and/or major equipment acquired included a Swingfog fogging machine; a 12-channel temperature recorder; a pressure booster pump for use with the steam generator; an industrial vacuum cleaner; and a misting control unit.

Nursery Stock

The number of nursery stock imports increased from 27 258 to 30 262. These included 21 161 orchids, 2 779 ornamentals and indoor plants, 1 350 cacti, 1 125 chrysanthemums, 988 bulbs and rhizomes, 848 carnations, 1 710 rose budding eyes, 11 aquatic plants, and 290 other cuttings which included fruit budding wood and cassava plants.

Parcel Post

A total of 16 316 parcels were intercepted for examination, an increase of 5 069 packages. Of these 4 068 were detained for further examination, treatment or destruction.

Processing at Approved Premises

The number of processors and premises approved by plant quarantine fell slightly to 131. These include seed stores, mineral and technical laboratories, timber yards, treatment and fumigation plants, container depots, furniture warehouses and factories processing such items as rye, linseed, beans, popcorn, cotton, jute waste and prunes.

Timber

Imports totalled 425 753 m³, being a decrease of 69 459 m³ over last year. The amount quarantined was 17 271 m³ being a decrease of 4 641 m³, and comprised:

	m ³		m ³
Meranti	2 011	Sepitir	30
Mahogany	3 310	Beech	56
Hemlock	1 750	Ramin	454
Oregon	1 407	Black Bean	133
Klinki	545	W.R. Cedar	256
Serayah	627	Various	82
Teak	100	Sabah Logs	6 503

The main infestations were *Bostrychidae* and *Lyctidae* in timber from South East Asia and *Scolytidae* and *Platypodidae* in timber from North America. A small quantity of timber was quarantined for being infested with termites.

Airport Inspections

Due to the continued introduction of larger aircraft, the number of overseas flights into Mascot Airport decreased from 8 155 to 8 050 but the number of passengers increased from 1 065 685 to 1 072 925. Quarantine examinations of passengers' articles increased from 57 959 to 63 010. Goods held and forwarded to Export and Import Branch for decision increased from 458 to 561. The number of seizures notices issued for subsequent action by Customs totalled 152, resulting in 49 quarantine prosecutions, all of which were successful.

Items detained included: citrus, pome and tropical fruits 13 137; stone fruit 210 kg; grapes 49 kg; maize and beans 585 kg; cereal seeds 197 pkts; vegetable and flower seeds 2 837 pkts; nuts 636 kg; olives 9 kg; dried fruit 205 kg; vegetables 366 kg; plants and cuttings (ornamental) 5 408; plants (commercial fruit) 797; bulbs 252 pkgs; flowers 446 pkgs; mushrooms 775 pkgs; soil 389 pkgs; soil 389 pkgs; straw packing 371 pkgs; herbs 385 pkgs; raw cotton 13 pkgs; wood and bamboo 322 pkgs; fruit cases 221; and 524 pine cones.

The following items subject to quarantine were collected from amnesty bins: Stone fruits 17 kg; citrus 793 pcs; pome fruit 1 479 pcs; tropical fruit 468 pcs; flowers 61 bunches; live plants 44; seed 15 pkts.

Consignments of cargo examined at the various bonds totalled 6 333 of which 627 were directed to Export and Import Branch for further inspection. Items imported were berryfruit 10 574 ctns; mushrooms 49 501 ctns; kiwi fruit 19 773 ctns; asparagus 2 152 ctns; garlic 573 bags; tomatoes 294 ctns; brussels sprouts 757 bags; tamarillos 2 184 ctns; feijoas 41 ctns; artichokes 202 ctns; mangoes 4 429 ctns; cabbage 250 cases; avocados 231 ctns; parsley 11 bags; corn cobs 250 ctns; celery 13 ctns; taro 17 ctns.

R.A.A.F. Airbase, Richmond

Overseas flights increased to 499 from 409 the previous year. Passenger numbers increased to 8 405 from 5 554 and cargo increased to 7 593 000 kg from 5 583 000 kg last year.

General Wharf Inspections

Approximately 1 400 overseas vessels (an increase of 359) were attended to inspect goods for which a quarantine permit was required. Quarantine action was required for: 1 968 motor vehicles; 109 320 kg walnuts; 207 286 kg other nuts; 203 375 kg cotton (for supervised processing); 4 787 000 kg copra; 203 087 kg phaseolus beans (for supervised processing); 975 t pasture seed; 1 860 000 kg cocoa beans; 243 750 kg coffee beans; 4 container loads of citrus (mainly grapefruit); 68 578 kg dates; 1 100 bales (138 000 kg) jute waste (for supervised processing).

Total import figures on these items are no longer available due to the discontinuation of the preparation of quarterly returns for the Commonwealth Government.

Overseas Passenger Vessels

A total of 169 passenger and naval vessels were attended on arrival for inspection of articles brought to attention by Customs officers. This was an increase of 35 on the previous year. A total of 1 713 interceptions were made and held for treatment or destruction.

Container Shipping

The number of conventional container vessels plying to the port of Sydney increased by 38 per cent:

							1977	1976
U.K.	..	..	..	..	..	..	21	15
U.S.A.	..	..	..	..	..	..	43	32
Japan	..	..	..	..	..	..	11	10
S.E. Asia	..	..	..	..	..	..	18	11
N.Z.	..	..	..	..	..	..	2	2
							—	—
							95	70
							—	—

There was a 17 per cent increase in the overall number of containers discharged:

						1977	1976
Conventional vessels	..	..	..	..	..	123 629	98 350
Itinerant vessels	..	..	..	..	..	9 316	15 115
						—	—
						132 945	113 465
						—	—

Examination of the manifests presented by various shipping companies resulted in 78 386 containers being permitted immediate delivery, 44 548 being directed to depots for inspection and 685 to approved premises for inspection. A total of 1 788 containers were given follow-up inspections and 169 did not conform with the coded information presented on the manifest. At container terminals 752 containers being discharged were placed under quarantine for soil contamination,

Household Effects

This type of cargo is inspected at approved premises throughout the metropolitan area. The number of consignments involved were:

	Number of Consignments	Consignments Quarantined
Grace Bros	2 439	345
Department of Supply	1 331	192
Various premises	1 502	257

General

- The number of permits issued during the year was 46 451, being an increase of 3 560 on the previous year.
- The interception of insects recorded totalled 1 320, a decrease of 30.
- Giant African Snail was detected on seven occasions on vessels trading on Pacific Island routes.
- Khapra beetle was detected on two occasions and cast skins on a further five occasions in ships stores of vessels trading from South East Asia.
- Carpenter ants were detected on two occasions.
- A total of 304 samples of seed were submitted for examination by the Seed Testing Laboratory of which 31 contravened 1 or more quarantine provisions, 28 contained prohibited weed seeds and 29 contained excessive quantities of restricted crop seed and excessive quantities of soil.

CUSTOMS AND THE COMMERCE (TRADE DESCRIPTIONS) ACTS (COMMONWEALTH)

Export regulations relating to agricultural products under these Acts and inspections to meet the plant quarantine requirements of overseas countries are administered by the Division of Horticulture on behalf of the Australian Department of Primary Industry.

Fresh Fruit and Vegetables

There has been an increase in the inspections conducted at the Flemington market complex on fruit and vegetables for export. This largely relates to produce prepared for export by air on a regular basis to the Pacific Island trade. The general quality of fruit and vegetables presented for inspection was good but rejections were high on occasions particularly for breakdown with onions and to a lesser extent for excess soil on potatoes. The main markets remained New Caledonia, Papua New Guinea, Fiji, Solomon Islands, Indonesia and Singapore. Some large parcels of cherries, plums, nectarines, melons and grapes were exported to Hong Kong with favourable outturn. There has been a trend towards loading refrigerated shipping containers at the premises of the exporter rather than the wharf.

The following produce was loaded in Sydney for overseas destinations:

	No. of Packages		No. of Packages
Apples	35 392	Cherries	7 493
Pears	51 468	Grapes	15 341
Oranges	48 656	Tomatoes	12 514
Mandarins	15 866	Strawberries	4 670
Lemons	3 363	Other fruits	2 853
Grapefruit	3 014	Potatoes	18 481
Apricots	1 142	Onions	81 625
Peaches	4 737	Garlic	1 093
Plums	3 920	Other vegetables	51 388
Nectarines	2 053		

Flour

There was a considerable decline in the quantity of flour exported, being down 24 000 t on the previous year to a total of 42 591 t. A total of 3 500 50-kg bags (175 t) were rejected, mainly for infestations with moth larvae, principally tropical warehouse moth, largely due to stockpiling by mills. An increasing proportion of the flour was exported in containers which require more intensive supervision and inspection.

Grain

The export of bulk wheat increased by 47 per cent over the previous year to 2 695 342 t. There was an increasing use of the Newcastle terminal and this trend will continue when construction of the forty new vertical storage bins is completed.

Statistics for the year were:

	Sydney	Newcastle	Total
Ships surveyed ..	92	74	166
Ships rejected ..	42	44	86
Bulk wheat (t)—			
loaded	1 490 539	1 204 803	2 695 342
rejected	11 867	3 420	15 287
Bagged wheat loaded ..	—	—	—
Bulk sorghum (t)—			
loaded	50 247	127 580	177 827
rejected	—	—	—
Bulk barley (t)—			
loaded	165 631	22 086	187 717
rejected	—	—	—

Rejections of grain were considerably less than in previous years reflecting a marked improvement in pest control techniques.

Export (General) Regulations

The principal items exported under these regulations are various seeds. Most are required to be shipped with phytosanitary certificates endorsed to meet the importing countries' requirements. Quantities were:

Pasture seed	9 882 pkgs	Maize seed	2 136 pkgs
Vegetable and flower seed	1 937 cons	Palm seed	4 013 pkgs
Nuts	1 765 pkgs	Tree seed	27 cons
		Plants	69 cons

The palm seed exported represented a 44 per cent increase over the previous year being largely *Kentia* palms from Lord Howe Island.

General

A number of commodities not subject to export regulations are inspected for the issue of phytosanitary certificates required by importing countries. The main items include rice, bird seed, stock feed and meals. A total of 3 523 phytosanitary certificates were issued to cover 75 016 packages of these and other items.

FERTILIZERS ACT

Inspectors made twenty visits under this Act, took seventeen samples for analyses and found thirteen non-registered fertilizers being offered for sale. Four samples of a commercial mixed fertilizer from the North Coast were found to be highly variable in composition.

In previous years, urea has been found to be present causing a serious problem in some fertilizers sold as blood and bone. Urea is capable of burning and causing death of sensitive plants, where unsuspecting nurserymen and other users have used some of these imitation blood and bone fertilizers containing urea. Samples taken in the most recent survey show that with one or two exceptions, urea was not found to be present in fertilizers, except where the registered analysis showed the reverse.

Commercial seaweed extracts have been sold in New South Wales for about twenty years. Because of their low nutrient content, they are not registered as fertilizers, but nevertheless many commercial growers are persuaded by intense promotional campaigns and advertising leaflets to use them. The exceptional benefits claimed cannot be justified in terms of their nutrient value. Analyses of two such materials confirmed that the total nutrients are insignificant compared with those found in commercial fertilizers or even animal manures or compost.

PEST DESTROYERS ACT

Applications for registration totalled 2 072 of which 567 were for registration of new products, 523 were for amendments to existing product labels, and 982 were re-registrations of existing products. Inspectors made 42 visits concerning investigations under the Act, and 7 non-registered pest destroyers were found being offered for sale.

AGRICULTURAL SEEDS ACT

Officers inspected 2 659 t of agricultural seed and sampled 110 lines of which 63 did not conform to the requirements of the Act. One successful prosecution was obtained and 49 warnings issued for breaches of the Act. In addition, inspectors took 115 samples for analysis for other purposes.

SEED PRODUCTION

Seed production officers located in the main seed producing centres, together with district agronomists throughout the State, supervised the production of registered cereal seed and certified seed of pasture species, maize, beans and potatoes.

Foundation and Registered Cereal Seed

Areas sown for foundation seed production at Temora Agricultural Research Station included 47 ha wheat, 5 ha oats and 3 ha barley. The crops were established under dry conditions but good spring conditions produced yields up to 4 t/ha with Egret. Ten seed growers were selected to produce foundation seed of established varieties for sale to registered seed producers. This development will allow the Research Station to use larger areas for multiplying new variety releases. Timson, the new University of Sydney wheat variety, was distributed to forty registered seed producers for multiplication. In addition, improved lines of Songlen and Egret were issued to interested growers.

Certified Pasture Seed

Total certified seed production was 765 t (685 t in 1975-6).

Subterranean clover: Production of seed totalled 398 t (362 t), comprising Woogenellup 260 t, Mt Barker 103 t, Seaton Park 20 t, Clare 4 t, Dwalganup 2t. Good seasonal conditions in the central west favoured production and yields of up to 1.5 t/ha were obtained. Production in the south was reduced by clover scorch disease and unfavourable conditions.

Barrel medic: A poor finish to the season and heavy weed infestations reduced production to 39 t (33 t).

Lucerne: Hay production following winter drought conditions in the south depressed seed production. In the west prolonged wet weather and the spotted alfalfa aphid prevented seed production. Average yields were obtained in the central west. Total production was 151 t (145 t).

Perennial ryegrass: Production of seed of the Kangaroo Valley varieties totalled 85 t (57 t).

Phalaris: Adverse seasonal conditions and limited demand reduced production of the four varieties to a total of 33 t (39 t).

Other certified seed produced included tall fescue 32 t, cocksfoot 13 t, white clover (var. Haifa) 18 t, kikuyu 4 t, hybrid maize 163 t, and beans 28 t.

SEED TESTING

Pre Control Testing of Certified Pasture Seed

Of the thirty-eight lines submitted for seedling evaluation, twenty-two failed to comply with purity standards.

Post Control Testing of Certified Pasture Seed

The varietal purity of the eleven barrel medic and thirty-four subterranean clover seed lines certified in 1975-6 was determined through field evaluation of plant rows. Six lines failed to comply with certification purity standards. Of the eighteen lines of perennial species tested, one failed certification purity standards.

SEEDS LABORATORY

The table shows a breakdown and comparison of seed samples tested in the years 1975-6 and 1976-7.

Type or Source of Seed	No. of Samples	
	1975-76	1976-77
Quarantine	456	734
Regulatory	382	313
Certified pasture	258	271
Certified maize and beans	195	217
Miscellaneous industry samples	443	908
Cotton industry	41	30
Rice industry	92	37
Departmental	1 647	880
Other Departments	158	126
Seeds for identification	22	89
Australian wheat collection	9 926	3 663
	13 620	7 268

NOXIOUS PLANT CONTROL

Officers of the Department assisted in survey and programme evaluation in regard to several plants already declared noxious and some which are under consideration.

Privet (*Ligustrum* spp.) removal from crown and other public lands would be a costly, lengthy operation with potential to cause irreparable harm to native bushlands. Consequently the Department initiated an impact study and is examining programme costs in an attempt to ensure that action is scientifically based.

Boneseed (*Chrysanthemoides monilifera*) has been used extensively for coastal dune stabilization and was the subject of a report on the need to declare it noxious. It was concluded that whilst boneseed could encroach into natural bushlands as a result of a lack of good overall management, declaration was not warranted.

Silverleaf night shade (*Solanum elaeagnifolium*) infestations were surveyed in those areas of the State where it was expected to be present and a considerably greater area of land carrying infestations, ranging from scattered plants to dense areas, was found. Research studies have also been undertaken to determine whether the plant is capable of causing productivity losses. The survey and research results will enable a rational decision to be made on whether the plant should be declared noxious in all areas.

Noogoora burr (*Xanthium pungens*) was surveyed along the Murray River and in nearby Riverina areas. Together with information coming from other parts of the State, particularly western areas, this indicated that Noogoora burr is a significant problem of grazing land in southern New South Wales.

Galvanised burr (*Bassia birchii*) control grants to councils and pastures protection boards have been made available by the Government since approximately 1970. Evaluation of the progress of this programme was undertaken during the year in central parts of the State. The plant has now been either reduced to reasonable maintenance levels or eliminated from travelling stock routes and other public lands in most of the eastern half of the area of original infestation. It is considered that the weed is also being contained in most other areas.

Serrated Tussock (*Nassella trichotoma*) infestations in many new areas have occurred and, with depressed prices for animal products, landholders have reduced their efforts towards replacing the weed with improved pastures. It is obvious that the present level of activity is inadequate to prevent further spread of the weed which would be a disaster to agricultural recovery in many tableland areas when prices for animal products rise.

Water Hyacinth (*Eichhornia crassipes*) control in the Gingham Watercourse, near Moree, has been initiated. The programme is based on an integrated approach involving water management, biological control, use of herbicides and surveillance, and involves a number of government and local government bodies. The Commonwealth, South Australian, Victorian and New South Wales Governments each contributed \$50,000 to the initial year's operation. Prior to extensive flooding commencing in March, the infestation had been substantially reduced and biological control agents established.

ANALYTICAL SERVICES

Reorganization of the Plant and Analytical Section of the Chemistry Branch has resulted in a more rapid service and an increase in the number of plants and soils analysed.

Plant samples analysed totalled 9 130. The samples were from trials, surveys, or for diagnostic purposes.

The number of soils chemically analysed totalled 9 524.

A wide range of samples were analysed in the Pesticides Section with a very high order of accuracy.

About 3 000 water samples were analysed to test for suitability for irrigation or for stock purposes. About 600 samples were analysed for the Water Resources Commission.

About 2 500 cereal samples were analysed, comprising export wheat and sorghum samples, flour samples and wheat samples from farmers variety trials, research station trials, plant breeders trials and regional variety trials. The samples are all subject to routine cereal chemical analysis and many are fully evaluated for milling quality, physical dough assessment and experimental baking.

Approximately 550 analyses were carried out on soil samples in relation to their physical properties and suitability for irrigation.

PLANT HEALTH DIAGNOSTIC SERVICES

Identification of pests attacking plants and plant products are made prior to advising on control measures. Specimens are identified for extension officers, primary producers and home gardeners. During the year 546 specimens concerning insect pests were submitted by post and 357 in person, and 2 930 telephone enquiries were received. A total of 4 627 insect specimens and 2 247 slides of mites were added to the collection.

A total of 902 specimens of plants submitted by post and 156 by in-person enquirers were examined for presence of disease, and control measures recommended where necessary. In addition 1 126 soil and plant samples were examined for the presence of plant parasitic nematodes as well as 42 specimens requiring identification of root knot nematodes were received and perineal patterns prepared. There were 260 specimens from samples mounted and added to the nematode collection.

In all, 637 enquiries were received on mushroom culture and disease control.

QUALITY ASSESSMENT

Australian Inoculants Research and Control Service (AIRCS)

This service was established and financed by the Australian Agricultural Council to control the quality of legume seed inoculants prior to release and to test the standard when available at retail outlets in all States. During 1976-7, 144 cultures were tested during production, of which 134 were passed. All 141 inoculant packets tested from retail outlets reached the necessary standard.

PLANT DISEASE RECORDS

During the year several new plant disease records for New South Wales were made and more than 2 000 plant disease specimens added to the Biology Branch Herbarium.

BOTANICAL SERVICES

The Royal Botanic Gardens and National Herbarium:

- identified 10 070 plant specimens arising from 2 755 enquiries and answered numerous additional telephone enquiries.
- despatched 4 408 specimens to other Australian and overseas herbaria in continuation of specimen exchange programmes, and received 5 207 specimens for incorporation.
- continued the monitoring of algal populations in farm dams, in association with other departmental officers, in the study of control treatments for toxic algal blooms.
- provided plant material for decorative effect in Government offices and Government exhibitions of various kinds.
- provided seed to other botanical institutions in Australia and overseas as part of regular exchange programmes and sent specimens and seeds in response to various requests arising from research studies.

6.2 REGULATORY AND TECHNICAL SERVICES ANIMALS AND ANIMAL PRODUCTS

REGULATORY DISEASE CONTROL

Tuberculosis and Brucellosis (Cattle)

The Australian Government contributed \$12 million or some 50 per cent less than the amount sought by the mainland States and Territories for the National Brucellosis and Tuberculosis Eradication Campaign in 1976-7. Since New South Wales is better prepared than the other States and had planned for a full scale programme the impact of the cutback in funds was more serious in this State. New South Wales sought \$9 million but only received slightly less than \$3 million which, together with the State contribution of slightly more than \$1 million, provided some \$4 million for the tuberculosis and brucellosis programmes for 1976-7.

The commencement of the test and slaughter phase of the brucellosis eradication campaign was delayed due to the uncertainty of future funding until December, when pilot activity was initiated in the northern part of the State. Additional staff appointments made in April/May enabled the test and slaughter phase to be expanded in the Pastures Protection Districts of Tweed/Lismore, Casino, Tenterfield, Inverell, Glen Innes and Armidale to involve some 8 000 herds and 1 million breeding cattle.

A preliminary meeting of State and Commonwealth representatives was held in October to determine a cost sharing formula for the triennium commencing 1977-8, but this and subsequent meetings proved unsuccessful. Until a satisfactory solution is devised for future funding, forward planning for an ongoing programme to achieve provisional freedom status for brucellosis throughout the State by 1984 is virtually impossible.

Activity in New South Wales during the year is summarized in the standard format adopted throughout Australia for the National Brucellosis and Tuberculosis Eradication Campaign. The salient features are briefly mentioned below.

Tuberculosis: Further progress was achieved in eradication during the year. The State herd and individual prevalence figures of 0.1 per cent and 0.002 per cent showed no significant variation. However, the number of reactors with lesions was 254—a reduction of 49 over the previous year. Also the number of cases with tuberculous lesions detected at abattoirs was 127 ex 3 204 961 animals slaughtered (0.004 per cent) compared with 119 ex 2 500 000 in 1975-6.

Bovine Tuberculosis for New South Wales—Provisionally Free Area

Number of cattle herds	..	..	..	..	..	..	70 733
Number of cattle	..	..	..	..	..	..	9 274 944

Monitoring—

● Meatworks—

Number of cattle slaughtered	..	..	..	..	..	3 204 961
Number with TB lesions (presumed plus confirmed)	..	..	..	..	..	127
Number of successful tracebacks to herd of origin	..	..	..	..	..	113
Percentage of successful tracebacks	..	..	..	..	..	89

● Testing—

Number of cattle tested	..	..	..	..	..	38 423
Number of reactors	..	..	..	..	..	75
Total number of herds tested	..	..	..	..	..	463
Number of herds confirmed infected	..	..	..	..	..	12
Number of herds tested from meatworks traceback	..	..	..	..	..	90

Eradication—

Number of infected herds	..	..	..	..	..	158
Number of herds tested	..	..	..	..	..	162
Number of cattle in infected herds	..	..	..	..	..	110 000
Number of individual cattle tests	..	..	..	..	..	108 156
Number of reactors	..	..	..	..	..	400
Disposal of Reactors—						
Number of reactors detected	..	..	..	..	..	475
Number of reactors slaughtered	..	..	..	..	..	475
Number of reactors autopsied (meatwork and field)	..	..	..	..	..	475
Number of reactors with lesions	..	..	..	..	..	254
Number of reactors for which compensation paid	..	..	..	..	..	464
Number of casual cases for which compensation paid	..	..	..	..	..	53
Net compensation paid (\$)	..	..	..	..	..	\$36,820

Laboratory—									
Number of bacteriological accessions	..	..	..	..	..	..	..	..	348
Number with confirmed tuberculosis	..	..	..	..	..	..	..	..	239
Infection Data—									
Number of herds infected at beginning of year	..	..	..	..	..	..	..	..	68
Number of cattle in infected herds at beginning of year	..	..	..	..	..	..	..	..	49 581
Number of herds infected at end of year	..	..	..	..	..	..	..	..	67
Number of cattle in infected herds at end of year	..	..	..	..	..	..	..	..	46 081
Prevalence (percentage)—									
Herd	..	..	..	..	..	..	..	..	0.1
Individual	..	..	..	..	..	..	..	..	0.002

Traceback by tail tags to the property of origin was successful in 89 per cent of cases detected at abattoirs. Since placing reliance on tail tag traceback the volume of testing was reduced significantly from 1 400 000 in 1974–5 to 330 375 in 1975–6 and to 146 579 in 1976–7.

Although ninety additional herds were detected the number remaining in quarantine at the end of the year was sixty-seven—only one less than 1975–6

Following the State's achievement of provisional freedom, the voluntary tubercle free herd scheme, which had functioned for nearly 50 years, was discontinued in August, 1976. At that time there were twenty-two herds in the scheme.

Laboratory examination was continued for specimens from suspected tuberculosis lesions. During 1972–6 a survey was conducted on lesions of bovine tuberculosis. Specimens were examined from 1 595 animals from which *Mycobacterium bovis* was isolated from 717 and *M. avium-intracellulare-scrofulaceum* (M.A.I.S.) and other *Mycobacteria* from 50. Of the M.A.I.S. strains isolated, 13 were serotyped revealing 9 *M. avium* serotype 2, 2 *M. intracellulare* serotype 5 and 1 serotype 10.

Brucellosis: The official control programme continued based on the compulsory vaccination at Government expense of female calves 3 to 9 months of age in protected areas and infected herds outside these areas with the aid of veterinary practitioners. Compulsory vaccination was extended from the Berriquin protected area to include seven pastures protection districts in the region of the District Veterinary Officer, Narrandera. Vaccinations with Strain 19 numbered 589 548. This was less than the previous year due to the tendency to unload heifers at an earlier age.

Abattoir monitoring increased by 55 per cent to 435 461 samples collected and showed a reduction in the percentage of confirmed reactors from 6.2 in 1975–6 to 4.2 in 1976–7. The overall figure in the compulsory vaccination area on the North Coast declined to 2.2 per cent whilst the Riverina level of 7.8 per cent in 1975–6 fell to 4.6 per cent.

The field survey neared completion and the additional 225 herds and 11 886 samples tested did not alter the established prevalence levels. Of the herds 10 per cent were randomly selected in pastures protection districts on the basis of herd size and geographical location and this data is invaluable in forward planning for the test and slaughter phase.

The percentage of dairy herds reacting to the milk ring test declined from 52 to 34.

Eradication testing commenced in the northern part of the State where 326 herds, selected on an infected herd priority basis, were brought under test and 1 293 reactors were detected in the 64 389 cattle involved. An outlet exists for brucellosis reactors in these areas.

Laboratory blood sample testing increased by more than 35 per cent. Bacteriological examination isolated *Brucella abortus* biotype 1 from thirteen cattle.

The first of five mini-computers was installed at the Regional Veterinary Laboratory, Wollongbar. This will be integrated into the national brucellosis recording system.

The voluntary brucellosis-free herd scheme was maintained and five herds were accredited.

The national brucellosis compensation scheme became operative as from 1st December in New South Wales with the Commonwealth contributing 75 per cent of the cost and the State Cattle Compensation Fund the remaining 25 per cent. The State compensation provision for the payment of \$25 to cattle owners who elect to have brucella reactors slaughtered on the property applied to herds outside the eradication areas. Compensation was paid for 2 433 brucella reactors including 307 under the national and 2 126 under the State schemes.

Bovine Brucellosis for New South Wales—Residual Area

Number of herds	70 733
Number of dairy herds	4 376
Number of breeding animals	5 487 464
Monitoring—	
● Meatworks—	
Number of females slaughtered	1 265 000
Number of bulls slaughtered	74 000
Number of blood samples tested	435 461
Number of confirmed reactors	18 595
Percentage of confirmed reactors	4.2
Number of herds checked	13 062
Number of herds tested from meatworks traceback	412
● Milk Ring Testing (MRT)—	
Number of herds checked	4 359
Number of herds positive to MRT	1 501
Number of herds blood tested due to positive MRT	8
● Abortion Investigations—	
Number of herds investigated	500
Number of positive investigations	97
Number of herds blood tested	498
● Field Testing (6 per cent, or Routine, or Sample)—	
Number of herds tested	1 923
Number of cattle tested	71 065
Number of reactors	2 381
Number of herds tested from traceback, all origins	918
● Total Monitoring—	
Number of herds tested	4 439
Number of herds positive	2 780
Number of cattle tested	553 774
Number of reactors	24 126
Eradication—	
Number of infected herds during year	721
Number of herds tested during year	326
Number of cattle in infected herds	181 459
Number of blood samples tested	64 389
Number of reactors	1 298
Disposal of Reactors—	
Number of reactors detected	6 829
Number of reactors slaughtered	8 505
Number of reactors for which compensation paid	2 433
Net compensation paid (\$)	\$66,932
Vaccination—	
Number of cattle vaccinated with Strain 19	589 548
Number of herds vaccinated with Strain 19	15 819
Number of doses of Strain 45/20 used	1 074
Number of herds vaccinated with Strain 45/20	46
Laboratory—	
Number of blood samples tested	660 213
Number of serological tests (RBT, SAT, CFT)	856 633
Number of bacteriological accessions	205
Infection Data—	
Number of herds infected at beginning of year	8 881
Number of cattle in infected herds at beginning of year	939 021
Number of herds infected at end of year	8 983
Number of cattle in infected herds at end of year	941 538
Prevalence (per cent)—	
Herd	29.5
Individual	3.1

Brucellosis (Pigs)

Brucellosis was not detected in pigs during the year. There were two positive reactions and seventeen doubtful reactions out of 1 608 serum samples tested. The reactors were negative on retest and the reactions are considered to have been non-specific. Under the voluntary brucellosis-free herd scheme thirty-two herds were accredited—a reduction of two on the previous year.

Tuberculosis (Pigs)

Specimens from twenty-eight pigs were examined in the laboratory and tuberculosis was confirmed in twelve.

In the past six years the following serotypes of the *M. avium-intracellulare-Scrofulaceum* group were isolated from pigs: One *M. avium* serotype 1, thirteen serotype 2, three *M. intracellulare* serotype 5, one serotype 9, one serotype 15, and two serotype 17.

Tuberculosis (Poultry)

Tuberculosis was detected in seven flocks which were quarantined. Five were in the recognized enzootic area in the southwest of the State. Control was by sanitation. Quarantine was maintained on eleven flocks infected before the start of the year. Nine were released. The tuberculin test is not generally applied to poultry but thirty-one birds in two flocks were tested. There were two reactors. Tuberculosis was confirmed in six specimens examined in the laboratory.

Johne's Disease

The presence of *Mycobacterium paratuberculosis* was confirmed in cattle in seven herds throughout the State. In one of these herds a diagnosis of Johne's disease was made on the basis of positive complement fixation test and positive culture but in the absence of clinical signs.

Anthrax

Six outbreaks were recorded. Total deaths were 18 cattle, 85 sheep, 5 pigs and 1 cat. Control was by vaccination and quarantine, restrictions being placed on 469 cattle, 9 284 sheep and 20 pigs. Voluntary preventive vaccination in the enzootic area for the disease was performed on 48 251 animals on 67 properties.

Footrot

The control procedures in the New England Protected Area were reviewed during the year. At the beginning of the year twenty properties in the area were in quarantine because of virulent footrot caused by *Fusiformis nodosus*. During the year a further twenty-four were quarantined because of fresh outbreaks while thirty were released after the disaster was considered to have been eradicated. Infection was successfully overcome by treatment alone in four flocks, by treatment and slaughter of obstinate cases in fourteen flocks and by slaughter of all infected and in-contact sheep in twelve flocks. At the end of the year fourteen properties remained in quarantine. Six were in quarantine for the full year.

A number of small flocks were quarantined in the Casino district. Local agents and owners had to be reminded of their responsibilities.

Babesiosis in Horses

Babesia equi infection was diagnosed for the first time in Australia at Bowral. A testing capability, using indirect fluorescent antibody technique, was developed at the Regional Veterinary Laboratory, Wollongbar. A survey of over 600 imported and local horses revealed eighty reactors of which only three had been clinically affected. There was no evidence of vector spread and almost certainly all transmission was by needle transfer. A policy of quarantine was enforced.

Equine Infectious Anaemia

The survey of horses throughout the State continued. A total of more than 1 600 horses was tested by immunodiffusion for antibody. There were six positive reactors.

Erysipelas

Erysipelothrix insidiosa (rhusiopathiae) was isolated on several occasions, the vast majority being from septicaemias and sudden death in pigs. Isolation from 119 pigs were serotyped and 1a, 1b and 2b were predominant. The distribution of these serotypes isolated from septicaemic pigs was similar to the distribution of serotypes isolated from arthritic pigs.

Lice and Keds

The number of sheep quarantined for lice infestation (*Bovicola ovis*) was 1 681 750 on 1 011 properties. For ked infestation (*Melophagus ovinus*) 4 140 sheep were quarantined on three holdings while 14 818 sheep were quarantined on nine properties on account of infestation with both parasites.

Salmonellosis

A number of outbreaks of salmonellosis were diagnosed in pigs, cattle (mainly calves), sheep and poultry. The only known commercial flock infected with *Salmonella pullorum* was slaughtered out by agreement with the owner. As a result this was the first year in which no commercial poultry breeding organizations were infected with this disease. However one flock of fancy poultry was found to be infected.

Vaccine Control

Considerable progress was made by the introduction of interim conditions for the manufacture of avian vaccines. These conditions included tests for the presence of reticuloendotheliosis virus in vaccines. This was made necessary by the occurrence of a serious disease in poultry layer flocks vaccinated with Marek's disease vaccine subsequently found to be contaminated with reticuloendotheliosis virus. At the time there was no known method for detecting this virus in Australia. Tests were subsequently developed which prevented the further distribution of contaminated vaccine.

Exotic Diseases

The largest exotic disease exercise yet undertaken was conducted at Cooma to control an "outbreak" of foot and mouth disease. Within two days the force of seventy departmental officers inspected all properties and arranged for valuation, destruction, burial or burning and final cleaning and disinfection.

Subsequently a smaller exercise was conducted at Maitland to assess the implication of an outbreak of Newcastle disease on a highly integrated broiler producing organization. Contrary to expectations the greatest loss to such an organization would not be the loss of genetic material but the loss of production capability. Representative type losses would be: Loss of genetic breeding stock, \$250,000; loss of production from breeding stock, \$1.5 million; loss of incubator capacity, \$4 million. The New South Wales Egg Board was also implicated and found that a major problem would be the disposal of the \$4 million of surplus egg production which must be sold on the export market.

ANIMAL HEALTH DIAGNOSTIC SERVICES

Mastitis

All dairy herds supplying whole milk (approximately 4 000) received a monthly somatic cell count of bulk milk as the basis of the Mastitis Advisory Service. The average cell count of the 51 factories involved was 535 000 cells/ml. Approximately one-third of these factories were less than 500 000 cells/ml—a level regarded as acceptable. On a herd basis, 51 per cent of suppliers had counts below 500 000 cell/ml. In herds exceeding this figures the estimated loss of production due to mastitis was estimated at 40 million litres of milk for the year. A fully automated milk cell counter capable of processing 200 samples per hour was installed at the Veterinary Research Station, Glenfield. This increased both the laboratory throughput and accuracy of results.

Bacteriological examinations were done on 635 milk samples collected for various reasons. Only 12 herds were sampled as part of a problem herd investigation, representing 239 samples of which 110 yielded *Staphylococcus aureus*, 6 *Streptococcus dysgalactiae*, 4 *Strep. agalactiae* and 4 *Strep. uberis*. Only 15 per cent of the *Staph. aureus* isolates from these herds were resistant to penicillin. Of the 197 samples received from clinical cases *Staph. aureus* was isolated from 67 samples of which 48 per cent exhibited penicillin resistance while resistance to other antibiotics was minimal.

Infertility

Cattle infertility was caused mainly by vibriosis, brucellosis, copper deficiency, phosphorus deficiency and undernutrition. Organisms isolated from bovine foetal tissue or vaginal discharge included *Campylobacter fetus*, *Brucella abortus*, *Escherichia coli* and *Leptospira* species.

Leptospirosis occurred widely, being manifested in cattle by abortion and calf mortality and in pigs by abortions, stillbirths and poor piglet survival. Of the 4 880 bovine serum samples submitted, 434 were positive to various serotypes, 52 per cent of which were *Leptospira hardjo* and 48 per cent *L. pomona*. Of 709 pig sera tested there were 95 positive reactions mainly to *L. pomona* with 3 per cent due to *L. tarassovi*.

In sheep the principal causes of infertility and abortion were brucellosis in rams (*Brucella ovis*), toxoplasmosis (*Toxoplasma gondii*), vibriosis and pasture oestrogenic compounds. Testing for brucellosis was undertaken on 1 079 properties. Of 40 044 sheep serum samples tested 4 368 were positive and 848 doubtful. This represented an increase in efforts to eradicate *B. ovis* by repeat test and removal of reactors.

Poultry Diseases

Among the 448 poultry consignments received at the Veterinary Research Station, Glenfield, for diagnostic purposes the most commonly diagnosed condition in fowls was reticuloendotheliosis (10.6 per cent) associated with Marek's disease vaccine contamination. This was followed by Marek's disease (8.6 per cent) associated with

failure to use vaccine due to the possibility of the above contamination problem. Staphylococcosis was a major cause of loss in broilers in the Tamworth district. Attention to hygiene and nutrition controlled this outbreak.

Trichinellosis Survey in Pigs

Evidence was secured that trichinellosis, which causes a disease transmissible to man, is not present in Australia. As part of a national survey 13 367 samples from New South Wales were found to be free from this parasitic disease.

Laboratory Diagnosis of Specimens

The number of specimen consignments submitted for examination at Departmental veterinary laboratories was 25 603—an increase of 13.7 per cent over the previous year. There was an increase at all four laboratories, the most marked (41.8 per cent) being at Wollongbar where it was associated with brucellosis eradication.

Particulars of specimen consignments are shown below:

Origin of Specimens to Departmental Veterinary Laboratories

Species	Glenfield	Armidale	Wollongbar	Wagga Wagga	Total
Cattle	9 736	3 333	2 579	1 559	17 207
Sheep	1 722	522	..	625	2 869
Pigs	755	175	376	252	1 558
Poultry	774	164	65	78	1 081
Other animals	1 110	688	707	221	2 726
Other specimens	91	25	37	9	162
Total	14 188	4 907	3 764	2 744	25 603

Sources of Specimens to Departmental Veterinary Laboratories

Source	Glenfield	Armidale	Wollongbar	Wagga Wagga	Total
Private practitioners ..	3 361	1 242	788	677	6 068
Veterinary inspectors ..	3 489	941	735	649	5 814
Departmental officers ..	7 259	2 546	2 230	1 374	13 409
Others	79	178	11	44	312
Total	14 188	4 907	3 764	2 744	25 603

CATTLE TICK AND TICK FEVER CONTROL

Control of cattle tick (*Boophilus microplus*) within the infested area in the northeast of New South Wales is exercised by the Board of Tick Control under the jurisdiction of the Department of Agriculture. The infested country embraces a number of quarantine areas from and within which the movement of stock is controlled.

During 1976-7 twenty-three holdings in the Tick Quarantine Areas were infested with cattle tick of which twenty were in the more favourable cattle tick areas east of the Richmond Range. Tick fever was found in stock on one property.

Tick Eradication Programmes

The Grafton-Copanhurst areas were released from quarantine on 30th June on completion of the examination programmes. All holdings were examined twice between February and June and no cattle ticks found.

Tick Control Programmes

Areas east of the Richmond Range: One month before the strategic dipping programme was due to commence the manufacturers of chlordimeform withdrew the product. Dips were then charged with amitraz in time to commence dipping in the Kyogle area in November and in the remainder of the area in January. Eight treatments were conducted in the Kyogle area and five in the remainder. The same area was covered as last year with some 373 000 cattle being dipped.

Areas west of the Richmond Range: In contrast with previous practice the strategic dipping programme was conducted simultaneously with the area West of the Range with five treatments between January and late April. Some 93 000 cattle were dipped.

All holdings in the Cullendore area were examined twice between February and June and no cattle ticks found. This satisfactory result placed this area in prospect of early release subject to further clean examinations next year.

Voluntary treatments: This policy, introduced last year, continued with 596 owners dipping 99 000 cattle.

Acaricide Resistant Ticks

All twenty infestations were subjected to eradication procedures as determined for resistant strains of cattle tick. Only ten of these could be effectively tested and all were confirmed as organophosphate resistant. Of these, four were Biarra, four Biarra and Mt Alford (including 4 per cent larvae showing DDT resistance in one sample), one was Biarra and Ridglands, and one was Ridglands.

Maintenance of Dips

In September, 1976, chlordimeform, which was the main acaricide used in the Tick Quarantine Area, was withdrawn from the market by the manufacturers. A change was made to amitraz in all the dips in the area under policy programme.

Work commenced immediately to pump out 1 000 dips containing chlordimeform. Charging with amitraz was then undertaken for all dips in the areas East and West of the Range covered by the policy dipping programme and sufficient dips in other areas to deal with infestations and provide for the third treatment prior to movement of stock to clean country.

Dips in use at the end of the year consisted of 816 charged with amitraz, 11 with promicide, 4 with dipofene and 238 with ethion.

It was intended to use amitraz for all stock. However, an early incident caused its withdrawal for use with horses. Four horses sprayed with amitraz became ill within 24 hours of treatment. One died and the remainder had to be destroyed. Animals exhibited impaction colic. Similar symptoms had been reported in horses in South America and Africa. Accordingly a limited number of amitraz dips were changed to promicide for the treatment of loose horses by dipping.

Dipping Mortalities

Compensation claims involving \$4,371 were paid for seventy-one head of stock which died from acaricide or injuries received during dipping. The marked reduction in the number of animals involved was a reflection of the safety of amitraz for cattle, including young calves.

Inspection of Stock

Examinations were continued for cattle arriving at abattoirs. Cattle ticks were found at the Casino abattoir on three occasions with trace back to the properties of origin in each case.

A total of more than 6 000 submissions, each comprising up to 50 specimens, was examined at the District Veterinary Laboratory. No cattle ticks were discovered in these specimens.

In August, the Department approved of the cattle tick control programme on tick fever infected holdings being reduced from 12 to 10 months to be in keeping with the programme on cattle tick infested holdings.

One case of tick fever occurred in the Kyogle area. No *Babesia* were seen in smears from the sick animal but blood changes were consistent with the diagnosis. Some 127 head on the infected holding were treated with Imidocarb®.

Twenty-nine stud cattle of Queensland origin were tested for nine owners for introduction into the tick quarantine area with negative results. These cattle received a precautionary treatment with Imidocarb® with no untoward effects.

Dip Sample Analyses

The Laboratory, Board of Tick Control changed from analysing ethion/chlordimeform dips to analysing mostly amitraz dips. The total number of chemical analyses was 11 676 and the number of residue samples 3 786. In addition, some 18 000 hair, pH, mud and lime estimations associated with these dip samples were carried out. Acaricides analysed included chlordimeform, amitraz, ethion, delnav, promicide, dipofene and ethyl bromophos.

® registered trade name.

Construction

Some 45 km of new fencing was constructed and 150 km of existing fence repaired on internal and external boundaries. Repairs were carried out on 301 dips and 98 dips were gravelled. Pumps, tanks and fittings were removed to store from dips in the Grafton/Copmanhurst area.

New installations included one 3-bedroom cottage, one cabin, two offices, one store, two sheds, three aluminium huts. Renovations and improvements were made to thirty-six other buildings.

Staff

Professional staff consisted of 3 veterinary officers, 2 research officers and 3 chemists. Ministerial staff at the end of the year numbered 341. Only 44 transfers of staff between sections occurred, compared with 138 in the previous year, as there was not the usual movement of field staff from east to west of the range for the dipping programme.

Safety

The number of accident reports was halved compared with last year with the same number of staff. Also the number of working days lost per 100 men fell to 96—a reduction of over 50 per cent.

Safety was improved at two external boundary gates on main roads. This was achieved by providing for livestock vehicles to move well clear of the road while permits were processed.

Sign posting was improved at all tick gates.

Summary of Activities

	Cattle	Horses	Hides
Number of dippings	3 086 913	2 446	..
Number of sprayings	25 649	31 334	..
Number of examinations	2 202 008	29 254	192 409

QUEENSLAND BORDER CONTROL

To prevent cattle ticks (*Boophilus microplus*) from entering New South Wales, control was maintained on the introduction of livestock, plants and some animal products from States where the parasite exists. Inspectors located on the Queensland border supervised the entry from Queensland of 240 478 cattle, 312 238 sheep, 18 094 pigs, 10 043 horses, 143 goats and 66 other animals.

Promacyl continued to be used in dips on the Queensland border for the treatment of stock entering from tick infested areas. The medicament for the treatment of introduced plant material was changed from diazinon to either promacyl or a combination of pyrethrin and piperonyl butoxide.

On the Queensland border two new cottages, one camp unit and a livestock inspection bay were built. Renovations and improvements were made to fifteen staff cottages, two dips and four camp units.

THE DAIRY INDUSTRY

Manufacture of Dairy Products

The Dairy Industry Act was amended to abolish table margarine quotas and the restriction preventing butter being taken on to margarine premises and *vice versa*. The legislation was effective from 20th May, 1977.

A total of 78 dairy produce factories, 5 margarine factories, and 173 dairy produce stores were registered under the Dairy Industry Act. This was 23 stores less than last year.

Factories were inspected jointly by officers of the Commonwealth Department of Primary Industry, the New South Wales Dairy Industry Authority and this Department. Seven remedial orders were issued to dairy produce factories and the upgrading of buildings and services to conform with the code of practice continued.

Examinations for certification of factory operatives were held. As a result 118 certificates of competency were issued: 37 for milk grading, 22 for milk testing, 15 for cream testing, 22 for milko-tester endorsement, 2 for cream grading, 1 for buttermaking and 19 for cheesemaking.

Quality of Dairy Products

Before distribution, regular examinations were made of butter and cheese manufactured in New South Wales or transferred from other States. In addition to grading in the Sydney Metropolitan Area, trained grading officers were located at four country centres.

A total of 713 124 (25 kg) boxes of butter and 6 104 (19 kg) boxes of cheese was graded. Grade certificates were supplied to local and interstate factory managers, processing and distributing agents, members of the Equalization Committee and district dairy officers. The information provided is a valuable tool in quality control and extension work.

An advisory code of practice for the interstate movement of butter came into operation. This was reflected in improved quality of interstate butter coming into New South Wales. Rejections dropped to 4 per cent. The main defect was rancidity although problems were experienced with surface taint.

Two retail butter surveys were conducted in the Sydney Metropolitan Area and one for the remainder of the State. Samples were subjected to sensory grading and chemical and biological analysis. Results showed an improvement on last year but unsalted butter caused some concern. Problem areas were brought to industry attention for correction.

Two cheese factories continued to grade cheese on a regular fortnightly basis. Grading and packaging on a quality basis ensured uniformity and consumer protection.

ANIMAL QUARANTINE

On behalf of the Commonwealth Government, the Department continued to administer sections of the Quarantine Act 1908-73 relating to the importation of animals and animal products and to the export of animals.

Importation of Animals and Animal Products

Revised conditions for the importation of horses from United Kingdom and Ireland was a major development during the year. The period of domicile in the specified countries was reduced to 2 months which, together with testing against specific diseases, became effective as from 31st January. The post-entry quarantine period in Australia was reduced to 14 days.

The use of air transport for importing animals increased. Of the horse imports from the United Kingdom, 77 per cent were transported by air whilst with New Zealand 80 per cent were involved. Regarding cattle from New Zealand the percentage by air was 54. Dogs and cats from both United Kingdom and New Zealand were well over 90 per cent in each case.

The following imported animals were held at the Quarantine Station, Abbotsford: 227 dogs and 71 cats imported from United Kingdom, one dog from Hawaii, 286 horses and 3 donkeys imported by air from United Kingdom and Ireland. An outbreak of ringworm in cats caused imports to be stopped for six months while animals were treated and the cattery disinfected.

Imports of cattle semen totalled 12 878 doses from United Kingdom, Ireland and New Zealand—only 10 per cent of that imported last year. Imports from Canada remained prohibited.

Thirteen cases of positive smuggling occurred. Also a number of animals arrived illegally by air. These were either overcarried from an overseas port to Australia or were declared prior to or on arrival.

Control continued over the importation of goods of animal origin. Certain items were visually examined as a check on the certificates provided. Additionally, in sixty-four instances, samples were submitted for detailed study to ensure that they had been adequately processed.

Federal legislation was enacted limiting the importation of cheese. Some 2 352 732 kg of cheese were imported without quarantine restrictions from countries free of foot and mouth disease and 1 703 798 kg from countries subject to certain limitations.

A five-fold increase of frozen or chilled meat from New Zealand brought the import this year from that country to 1 200 000 kg.

Passengers' Baggage

Co-operation with Customs officers continued in searching for illegal goods in the baggage of over 1 million passengers and crew arriving by sea or air. Some 7 858 commercial and 501 military aircraft flights and 146 ship arrivals were supervised. Seizures were made from 4 388 passengers among the 67 174 referred to

animal quarantine officers. Principal seizures of illegal imports included 1 921 kg meat, 1 334 kg cheese, 1 168 kg trahana and 1 784 eggs.

Of the ships met 77 per cent originated from the Far East or from Pacific cruises, a significant factor in relation to the risk of importing prohibited materials. Disinfection of footwear and work clothes brought by incoming air passengers, who had been associated with rural industries in countries where foot and mouth disease exists, continued and footwear was disinfected from 1 841 passengers.

Parcels Post

Liaison was maintained with Customs officers at the Redfern Mail Exchange and at Newcastle and Port Kembla post offices. A total of 4 146 parcels were referred for quarantine inspection and from these, part seizures were made from 394, complete seizures from 200 and goods in another 86 parcels were submitted to fumigation. Items seized included 367 kg meat, 80 kg milk products, 324 kg cheese, 61 eggs, 13 kg moon cakes, 82 kg noodles, 26 drums and 42 rawhide items. The marked increase in the quantity of cheese seized was notable.

Ships' Pets

Strict supervision of animal pets on overseas vessels in port was maintained. Shipmaster's bonds were taken out on 201 occasions. During the year, three bonds were estreated following the escape of pets.

Approved Premises

Surveillance was maintained over zoological gardens and circuses registered in New South Wales as well as visiting circuses. Additional registrations during the year brought the total registrations to thirteen zoos and nine circuses. Regular visits were also made to the thirteen scientific premises in the State approved to import laboratory animals for research purposes.

Export of Animals

Control over the export of animals involved inspections and sometimes the supervision of treatments as required by the importing country, and the issue of 1 845 health certificates.

MEAT INSPECTION

The Department made further progress in assuming responsibility for meat inspection purposes of the entire domestic meat trade in the State. The State Meat Inspection Service inspected livestock immediately prior to slaughter, inspected their carcasses during slaughter and dressing, and stamped those carcasses or parts deemed fit for human consumption. Such functions were carried out at twenty-nine export abattoirs in conjunction with the Commonwealth Department of Primary Industry and also at seven non-export abattoirs and at an increased number of slaughterhouses throughout the State.

Other important functions included the preslaughter moulting of lambs, pre-slaughter sanitation check, supervision of interstate and local trade loadout of carcass meats, the reinspection of meat introduced into the Sydney metropolitan abattoir area from interstate and the collection and feedback of information on livestock diseases to field staff.

Carcasses and viscera of 2 963 647 adult cattle, 467 479 calves, 8 439 397 sheep and 1 008 797 pigs were inspected at abattoirs and 1 013 cattle carcasses, 997 sheep carcasses and 30 horse carcasses at knackeries. Numbers of carcasses wholly condemned for the more common conditions are shown below.

Whole Carcass Condemnations

Cause	Cattle	Sheep	Pigs
Bruised	385	1 187	14
Cancer	1 936	2 341	24
Caseous lymphadenitis	..	47 492	..
Cysticercus ovis	..	1 316	..
Cysticercus bovis	7	7	..
Emaciation	1 130	13 062	27
Fever, pyaemia, septicaemia	1 853	4 542	914
Hydatids	308	3 359	77
Jaundice	35	1 667	18
Polyarthrititis	149	8 585	3 367
Sarcosporidiosis	13	8 642	..
Sparganosis	..	..	47

The quantity of meat re-inspected after introduction into the metropolitan abattoir area from other States and New Zealand was 78 036 beef carcasses, 160 942 calf carcasses, 194 303 sheep carcasses, 54 271 pig carcasses, 5 398 556 kg beef pieces, 383 866 kg veal pieces, 70 175 kg mutton pieces, 3 825 140 kg pork and bacon pieces, and 391 233 kg sundry pieces. Only small quantities were condemned, mainly for contamination and putrefaction.

NOXIOUS ANIMALS AND INSECTS

Rabbits (Oryctolagus cuniculus)

Control of the rabbit is administered by the Department and organized by the pastures protection boards. The principal methods used were poisoning, ripping, fumigating, trapping and the liberation of myxoma virus.

Sodium fluoracetate (1080) was the commonly used poison. This poison is only available for the destruction of vertebrate pests declared noxious under the Pastures Protection Act. It may only be used by authorized persons employed by a department or pastures protection board. The names of such persons are registered as authorized personnel by this Department.

Myxoma virus was produced at the Veterinary Research Station, Glenfield which supplied 49 760 rabbit doses to pastures protection boards and owners. A further 2 000 doses were supplied to rabbit control authorities in Northern Territory and Australian Capital Territory.

Rabbit populations in eastern and central New South Wales were reported to have declined to the lowest incidence for several years. However, individual properties with high density pockets were still evident. In the Western Division numbers remained at high levels.

Wild Pigs

Wild pigs received increasing public recognition as a cause of significant economic loss particularly to grain production and by lamb predation. Wild pig control is initially the responsibility of the landholder under the Pastures Protection Act. Some groups of landholders moved toward the formation of wild pig control groups. Owners in one scheme established a fund to cover special circumstances such as the employment of labour and to cover costs of wild pig control of unoccupied lands adjoining private lands within the scheme.

Wild Dogs

A seminar on the control of wild dogs was held on 5th August, 1976, at the direction of the Premier. There was strong representation from dingo destruction boards, pastures protection boards, landholder interest and organizations interested in the preservation of the environment. The seminar revealed a surprising degree of agreement. The main concern of most of the environmental interests was the preservation of native fauna, including wild dogs, in national parks but the need for selective aerial baiting in trouble spots was conceded.

Pastures protection boards and dingo destruction boards required ministerial approval before undertaking wild dog control campaigns using aircraft to distribute fresh meat baits impregnated with 1080. Eight separate drops were approved.

The quantity of bait material used for both aerial and ground baiting included 6 943 kg of fresh meat and 2 710 kg of offal. Bait size approximated 250 g and the recommended application rate of 1080 was 0.014 g per g of bait. The quantity of 1080 purchased was 122 kg—approximately the same as last year. A reduction in use of 1080 for rabbit control was balanced by an increase in its use for wild pig control.

Australian Plague Locust (Chortoicetes terminifera)

Extensive plague locust infestations occurred in the Riverina during the spring and summer of 1976. This was due to eggs laid following migration into southern New South Wales the previous autumn. There was extensive activity in the central west and some activity in the northwest and Western Division during the autumn of 1977. There is widespread overwintering of eggs.

Landowners were active in control operations on individual properties. The Department was actively engaged in co-ordination and control using both aerial spraying and self-propelled ultra-low volume misting equipment against hopping bands and adult swarms. For the first time the Department incorporated aerial spraying of bands in campaign strategy. About 22 000 hectares of locust bands between 3 and 5 weeks of age were treated in the Hillston district in early November. This significantly reduced migration into irrigation areas.

The main control activities commenced on 5th November, with co-ordination centres established at Narromine, Narrandera and Hay. Aerial spraying of bands and adult swarms was carried out in November and December in the southwest and was terminated following broad defusion of swarms over a 300 km front extending from Wagga to Deniliquin. The Department of Defence made available a helicopter and service personnel for survey duties in the central west and northwest areas of the State. The survey was carried out in conditions that were too wet for groundwork due to excessive rain.

Insecticides used during aerial spraying included technical fenitrothion 37 600 litres, technical diazinon 11 200 litres and technical maldison 2 000 litres. Insecticides used for ground spraying by landholders were 150 000 litres of both 50 per cent maldison emulsion and 16 per cent lindane emulsion.

PESTICIDE RESIDUES

The residue epidemiological case study, which started in January, 1975, continued throughout 1976-77 with sampling of cattle at abattoirs under the Stock (Chemical Residues) Act. Initially sampling was confined to areas where residues were most likely to be found. In the last 6 months sampling has been extended to abattoirs on the North Coast. This has resulted in a fall in the percentage of positive samples since there was less bias in the selection of samples.

A total of 16 675 samples was collected from animals from 6 595 properties. Residues detected to the end of June, 1977, numbered:

DDT. 6 489 (38 per cent) samples were positive with 6 218 below 50 per cent of the actionable level (5 p.p.m.), 98 between 50 per cent and 100 per cent and 73 above the level. There was no decrease in the incidence.

DDT usage was restricted to situations where no satisfactory alternative existed. It is not used extensively on cotton and it has almost been replaced by other pesticides for lucerne seed production.

Dieldrin. 471 (2.8 per cent) samples were positive with 325 below 50 per cent of the actionable level (0.3 p.p.m.), 94 between 50 per cent and 100 per cent and 52 over the level.

Its use as an insecticide on animals was withdrawn in 1965 but it still finds limited usage in soils and against white ants. It persists for long periods in the soil. Despite the limitations on its use the occurrence in fat samples has shown little decline.

HCB. A total of 219 samples were positive with 173 below 50 per cent of the actionable level (0.5 p.p.m.), 11 between 50 per cent and 100 per cent and 35 over the level.

This chemical was used as a bunticide on seed wheat until 1972 when it was banned. Large numbers of fat samples continued to show positive but the number declined in the last six months.

Heptachlor. Thirty-seven samples were positive with twenty-seven below 50 per cent of the actionable level (0.3 p.p.m.), seven between 50 per cent and 100 per cent and three over the level.

This was used against a range of soil insects and is able to persist for long periods in the soil. It is capable of translocation into plants.

Ethion. Twenty-three samples collected near the Queensland border were positive with five below 50 per cent of the actionable level (2.5 p.p.m.), eight between 50 per cent to 100 per cent and ten over the level.

This has been widely used against ticks but because of the development of resistant strains and because it accumulates in the fat of the animal it is being replaced.

Other insecticides recorded were lindane eight times; oxychlordane one; aldrin eleven; and BHC two.

The number of properties detained varies as new ones are added and others are released after residues in the cattle on the property drop to acceptable levels. At the end of June, thirty-five properties were in detention for: dieldrin thirteen scattered throughout the State, DDT sixteen mainly in the cotton growing areas, BHC two, HCB two and heptachlor two.

MISCELLANEOUS LEGISLATION

Cattle Compensation Act

Compensation was paid for 2 933 cattle ordered to be destroyed on account of suspected disease and 53 carcasses condemned during meat inspection. The marked increase in cattle ordered to be slaughtered was due to brucellosis. Owners agreeing to destroy reactors on the property received a flat rate of \$25 compensation per head. In eradication areas the maximum compensation allowed was \$150 per reactor but payments were offset by the carcass value of the beast ordered to be destroyed.

The local office voucher system was introduced into district veterinary offices where claims are received, checked and forwarded for payment.

Particulars of the diseases on which claims were paid follow:

Disease					Claims	Cattle and Carcasses
Brucellosis	..	..	..	..	99	2 433
Johnes disease	..	..	..	..	8	15
Tuberculosis	..	..	..	..	150	517
Tick fever	..	..	..	..	1	1
Trichomoniasis	..	..	..	..	1	20
Vibriosis	..	..	..	..	..	..
Total	..	..	..	..	259	2 986

Claims outside the 60-day statutory period allowed for lodgement numbered 18. All were approved for payment in full. Twenty-three claims for *ex gratia* payment to owners for out of pocket expenses for freight and killing charges were received. These were all passed and payment made.

Swine Compensation Act

Claims paid for pigs ordered to be destroyed on account of suspected disease and carcasses condemned during meat inspection follow:

Disease					Claims	Pigs and Carcasses
Tuberculosis	..	..	..	..	9	10
Septicaemia	..	..	..	..	23	106
Total	..	..	..	..	32	116

Stock (Artificial Insemination) Act

Artificial insemination of cattle declined further with two artificial breeding centres being closed. There were 116 bulls in centres at the end of the year compared with 115 for the previous year. Semen imports from overseas totalled 12 878 and represented 7 breeds of cattle. This compared with 129 602 for last year with 13 breeds.

Rejection of semen from overseas for poor quality was limited due to the small quantity imported.

Further testing of mannosidosis in Angus and Murray Grey cattle took place. No animals were rejected at artificial insemination centres for this disease.

Certificates of Competency under the Act were issued to 21 persons for the insemination of cows and to one person for the collection, appraisal, dilution, storage and packaging of sheep semen.

Stock Foods and Medicines Act

Registration was granted to 1 283 stock foods and 1 575 stock medicines. Of the latter 163 were new preparations not previously registered. Inspectors detected 213 unregistered stock medicines and 147 unregistered stock foods. These products reported as being unregistered were in many cases duplicated since they are found in more than one store. As a result of the manufacturers being informed most of them were subsequently either registered or in the process of being registered.

One manufacturer was prosecuted for failing to register following continued sale of the product in spite of a previous warning.

Veterinary Surgeons Act

Inspectors investigated an increased number of complaints against veterinarians treating animals negligently, breaching advertising regulations, and the practice of veterinary science by non-veterinarians particularly related to greyhound racing.

An appeal against the removal of a veterinarian's name on the Veterinary Surgeons Roll for 12 months was unsuccessful in the Appeals Court.

Swine Branding Act

Regular inspections were made of pigs at saleyards and abattoirs and of agents' records. There were two prosecutions for failure to brand pigs sent to saleyards and abattoirs.

Prosecutions under the Stock Diseases Act

Prosecutions were undertaken under the Act or its regulations for 109 offences. Of the 104 successful prosecutions 47 were for breaches of the regulations governing the application of tail tags to cattle being sold; 20 were for failure to notify the presence of lice in sheep; 13 for selling, offering, or attempting to sell diseased stock; 4 for causing to be moved diseased stock; 4 for diseased stock found to be straying; 2 for owners of diseased stock refusing to comply with an order; 1 for illegal movement of stock within a quarantine area; 3 for feeding of swill to pigs; 2 for illegal movements of pigs from saleyards to a property; 1 for failure to comply with an order to have poultry suspected to have pullorum disease tested; 7 for illegal movements of stock from Queensland to New South Wales including movements into the Tick Quarantine Area.

APICULTURE

The incidence of American foul brood disease (*Bacillus larvae*), the most serious infectious disease of bees in this State, was low. A total of fifty-one infected hives in twelve apiaries was destroyed. Compensation was paid in accordance with usual practice.

Escorts from 198 imported queen bees were examined for disease as required under the Quarantine Act 1908-73.

MISCELLANEOUS SERVICES

Drought Relief

The Department was responsible for the declaration of drought affected areas and the overall administration of relief schemes associated with such declarations.

A serious drought situation was experienced in southern New South Wales during winter and spring. One of the major forms of drought relief was the provision of road and rail transport subsidies on the movements of livestock and fodder. Expenditure on road freight concessions was \$772,277. The Public Transport Commission administered rail transport subsidies.

The Department also administered a new drought relief scheme during the year—a livestock slaughter compensation scheme. Under this scheme stockowners were paid \$10 per head compensation for cattle slaughtered because of the drought. For the 1 680 cattle slaughtered the total cost, including administration costs paid to local government authorities and pasture protection boards, was \$18,266.

Public Watering Places

Watering facilities are provided at camping reserves strategically located every 16 to 20 km along the major travelling stock routes in the Western Division. Maintenance and improvement continued at a rate similar to that of previous years with an expenditure of \$137,000.

Fleece Measurement Service

The Department's Fleece Measurement Service was re-organized and now provides a fibre diameter and fleece weight classification to all participating breeders of rams. This new service commenced in July, 1976, and over 3 000 samples were processed. This was possible through the utilization of the liquid scintillator counter located at Trangie Agricultural Research Station. Financial support for operational costs was provided by the Wool Research Trust Funds.

Sheep Fertility Service

This service is now based at Wagga. Some 100 properties were visited to investigate low lambing performance and detailed trials were conducted on 21 properties. It was supported by the Wool Research Trust Funds.

Performance Recording Service

The Department operates a correcting weaning weight service for British breed sheep studs.

Brands and Earmarks

New applications for large stock brands totalled 1 248 and the transfers from one proprietor to another were 392.

Sheep earmark transfers and original applications totalled 1 005, colour brand transfers and new applications totalled 766 while 9 fire brands were allotted. There were 572 swine brands allotted, 63 transfers and 41 licenses issued while 105 brands were cancelled.

Tail Tags

Numbers of certificates and exemption licences issued for cattle tail tagging were: New certificates, 3 240; certificates reallocated, 1 245; certificates cancelled, 73; new exemption licences issued, 22.

6.3 MARKETING SERVICES AND SERVICES TO OTHER ORGANIZATIONS

PRICE REPORTING

The Division of Marketing and Economics continued to collect and disseminate wholesale market information as required under the Marketing of Primary Products Act, 1927.

A Livestock Market Reporting Service was initiated in June, 1977, to provide comprehensive price quotations for specified standards of livestock description at Homebush Markets and to set standards for livestock market reporting throughout the State. Markets reports for pigs at Homebush were continued, as were reports for fruit, vegetables and cut flowers at the Sydney Farm Produce Markets at Flemington, on each day these markets traded.

Prices for grains, butter and cheese, bacon and hams, honey, bran, pollard and eggs are also collected and reported on a weekly basis. The wholesale and retail prices of stockfeeds are collected and published monthly and wholesale prices of dressed poultry are regularly recorded.

Retail prices of fruit, vegetables, fish and meat were also collected daily at various retail outlets throughout the metropolitan area.

All publications of the Division covering market prices were continued. Daily wholesale price quotations giving detailed market information were supplied to the daily press, periodicals, various Federal and State government departments and other bodies.

The widely distributed *Weekly Marketing Notes*, summarizing the week's activities in all the metropolitan markets, continued. Also the recording and monthly publication of *Cool Storage Statistics*, covering the quantities of apples and pears held in cool and controlled atmosphere storages throughout New South Wales, were continued. The regular *New South Wales Production and Marketing Reports for Beef, Fruit, Sheep, Pigs and Vegetables*, summarizing production and average monthly wholesale prices for recent years, were again published.

Records of selected arrivals into Sydney markets of various primary products, from both interstate and intrastate sources, were maintained.

Summaries of the market information supplied by the Division were broadcast daily by the Australian Broadcasting Commission (including regional relays and interstate hookups) and by some city and rural commercial radio stations. Reports of the Livestock Market Reporting Service were also disseminated by AAP-Reuters.

Crop and Livestock Reporting Service, Crop Reviews and Forecasts

The Division continued to provide regular crop reviews and forecasts. Acreage estimates and production forecasts were again published for the State's wheat, oats and barley crops. Production estimates for oranges, lemons, mandarins and grapefruit were published at regular intervals during the past 12 months.

Publication continued of the monthly *Report on Production Trends* which included a summary of seasonal conditions and comment on the seasonal progress and production prospects for more than twenty of the more important crops grown in New South Wales; also included were details of monthly slaughtering and production figures for cattle, sheep, lambs, pigs and poultry, as well as production figures for butter, cheese, milk and eggs; wool receivals and sales through brokers' stores were also covered in this monthly report.

Publication also continued of the monthly survey of *New South Wales Pastoral Conditions* which reported on seasonal conditions, the pasture and feed situation, the condition of stock and the noxious pest problems in more than fifty districts of the State.

SERVICES TO OTHER DEPARTMENTS AND ORGANIZATIONS

This Department provides a comprehensive range of services to other departments and organizations, too numerous to be listed individually. The following examples indicate the range of services provided.

Further assistance was given to the Australian Development Assistance Agency in the conduct of a feasibility study in Sri-Lanka and the provision of technical advice for projects in India and South Korea.

Veterinary assistance (a total of 190 services) was provided to livestock on properties administered by the State Departments of Education, Corrective Services, Police, and Youth, Ethnic and Community Affairs, the Health Commission and the Dairy Industry Authority. Assistance was also provided to the University of Sydney, CSIRO, Taronga Park Zoo, National Parks and Wildlife Service, and South Australian Institute of Medical and Veterinary Science.

Plant identifications were provided by the Royal Botanic Gardens and National Herbarium to various government and private organizations, including the National Parks and Wildlife Service, Forestry Commission, Police Department, Bureau of Customs, and universities. Algal identifications were provided for various groups, including the N.S.W. State Fisheries, the Water Resources Commission and universities. A vegetation survey of the Mangrove Creek Dam catchment area was carried out for the Department of Public Works and reports on environmental aspects of proposed developments were provided for the Electricity Commission and the State Pollution Control Commission.

The State Meat Inspection Service continued to provide a large number (a total of 517) of pathology and anatomy specimens to teaching and research institutions including various universities, the CSIRO, hospitals, technical colleges, high schools, private companies and the Red Cross Blood Bank of N.S.W.

Commonwealth departments were provided with many special or regular reports including: information of prospects for the State's rural industries; availability of various types of agricultural machinery and levying of import duties thereon; availability of Australian manufactured agricultural machinery suitable for use in a project in India.

Departmental resources were made available to various research institutions, including the State universities and CSIRO, both in joint programmes and related agricultural research.

The Agricultural Research Centre, Tamworth, continued to provide a wheat testing service while the Australian Wheat Collection again serviced all wheat research groups in Australia.

Advice on statistics and computing was given to various State and Commonwealth departments and institutions.

The Bureau of Agricultural Economics continued to be supplied with a wide range of agricultural information, including estimates of woolcuts and wool production and information on seasonal conditions and crop prospects.

At the request of the Department of Mines, over sixty inspections and reports were made under the Mining Act to assess land classifications where applications to mine or prospect were contested by landholders.

Other advice and/or assistance provided included:

- to the Department of Lands on closer settlement and rural assistance;
- to the Department of Local Government, shire and municipal councils on the Argentine ant eradication campaign;
- to various authorities on the presence of the Australian plague locust;
- to grain authorities on insects in grain;
- to the Health Commission on safe use of insecticides;
- to the Department of Mines on the gas pipeline in relation to primary production;
- to the Department of Youth and Ethnic Services through the Bush Fire and Flood Relief Committees.

6.4 GARDENS, DOMAINS AND PARKS

ROYAL BOTANIC GARDENS

Discussions were held with representatives of the State Planning and Environment Commission and the Macarthur Development Board in relation to the proposed development of an arboretum within the Campbelltown–Camden–Appin new cities area as an annexe to the Royal Botanic Gardens. Lands suitable for the purpose have been identified to the Macarthur Development Board.

Two severe hailstorms in November followed by dry weather and high temperatures in December and extremely wet conditions in the latter part of February caused damage to plantings and resulted in some maintenance problems and difficulties in preparation for the visit of Her Majesty Queen Elizabeth II and His Royal Highness Prince Phillip to Government House and the Royal Botanic Gardens.

Large crowds gathered in the Royal Botanic Gardens on Sunday, 13th March, 1977, on the occasion of the visit of Her Majesty Queen Elizabeth II to open the Queen Elizabeth Walk which extends around Farm Cove from the northwest to the northeast entrance gates of the gardens.

Due to the introduction by the Public Service Board of a new policy on staff ceilings difficulties were experienced in the maintenance of an adequate staff strength for the institution's requirements. During summer the development of annual seasonal bedding displays was discontinued to ensure adequate attention to more valuable permanent plantings. Such forced economies became a matter of public comment.

The kiosk in the Royal Botanic Gardens was destroyed by fire on the night of 19th March. The southern wall, which was the main architectural feature of interest in the building, and the base courses remain but the majority of the structure was damaged beyond repair.

Improvements Effected

The Department of Public Works completed the reconstruction, kerbing and sealing of the harbourside walk extending around Farm Cove from the Opera House entrance gates to Mrs Macquarie's Point. That Department also undertook an extensive programme of renovation and improvement works to staff facilities, cottages, toilets and other buildings as part of its scheme to reduce maintenance areas in government institutions. The Minister approved the letting of a contract for further restoration of the historic Macquarie Wall. Work continued with the development of the new Cactus and Succulent Garden with the construction of timber screens and installation of drainage and water services facilities.

A total of 99 plants representing 20 species and varieties were planted in the Middle Garden, in the further development of educational thematic plantings. The exhibition planting of azaleas adjacent to the historic Macquarie Wall was augmented with the addition of some 45 new varieties. In addition 8 new species of trees were planted in the area. Plantings of native species in the area surrounding the administration office building were extended with the addition of some 124 plants representing 32 species, whilst the area adjacent to the small creek which flows through the Upper Garden was enhanced with plantings of rainforest species, ferns and azaleas representing 27 species.

Plant Production and Glasshouses

Expansion of the range and quantity of material continued with the propagation and development of local and overseas introductions. Plans to overcome problems due to lack of space and inadequate facilities are being implemented. Production and maintenance of nursery stock continued satisfactorily. Enough material was provided for the replanting and landscape development projects and for the restricted massed seasonal floral displays.

The pyramidal shaped Tropical Glasshouse was opened to the public on 1st July, 1976. The Glasshouse, with its striking arrangement of ornamental foliage plants, ferns and selected flowering species, has proved a major public attraction with over 120 000 visitors and 1 800 personal inquiries being handled during the first year of operation.

Provision of plants and floral decorations for Parliament House and certain government offices and exhibits continued.

Landscape Designing and Associated Services

External: The landscape design section made inspections, and where appropriate prepared reports for Coffs Harbour Council, Campbelltown Hospital, Holroyd Municipal Council and the Cowra Tourist Development Association. Services available to external institutions remain restricted due to continuing heavy internal demands.

Internal: Apart from directing works associated with general development of the Royal Botanic Gardens, the Mount Tomah Annexe and Domains and the restoration and development of Centennial Park, the principal internal projects were: relandscaping of the area adjacent to Cottage No. 4 which included the construction of sandstone walls, paving and timber screens; further restoration of parkland following realignment and reconstruction of Mrs Macquarie's Road; preparation of plans and site works associated with landscaping the surround of the supervisor's residence and office at the Mount Tomah Annexe; preparation of plans for development of cycle-ways in Centennial Park and the Domain Fun and Fitness Track; further restoration under contract of the historic wall and site works and landscaping associated with preparation for the visit of Her Majesty Queen Elizabeth II.

Action was completed to enable acquisition of a small parcel of land adjoining the southwestern boundary of the annexe which is important to the protection of existing rainforest vegetation on the periphery of the annexe and to the functional efficiency of the proposed water reticulation system. Contractors completed work on construction of Stage I of new depot complex and site works associated with landscaping around the supervisor's residence and office were begun. Collections of plant material being established in the nursery for later planting and development of the annexe were further expanded with material transferred from the Royal Botanic Gardens nursery and by exchange with other institutions and individual collectors.

The Inner and Outer Domains were satisfactorily maintained and further improvements effected. These included completion of stage 4 of the Mrs Macquarie's Road reconstruction programme; restoration of areas affected by these roadworks as well as those affected by the construction of the Eastern Suburbs Railway; reseeding of areas denuded of grass; surface improvement to playing fields and the planting of some sixty-five advanced sized trees comprising fourteen different species. The Domain continued to be popular for Sunday public oratory and was used for the formation and disbandment of processions and gatherings of civic or national significance. Playing fields for football and netball again received maximum possible usage. Joggers and other athletes continue to find the area popular for training purposes resulting in increasing conflict among user groups. Plans have been approved for the construction of a fitness obstacle track within the area bounded by the Cahill Expressway, Art Gallery Road and Hospital Road.

Royal Botanic Gardens staff continued to maintain the grounds and provide interior floral services for Government House and Admiralty House, the Governor-General's Sydney residence. In spite of seasonal difficulties, the grounds were brought to a highly satisfactory level of appearance for the Royal visit in March, 1977.

Internal floral decorations were also provided for Government House, Canberra.

Restoration and improvement of Centennial Park continued, though not at its usually high standard due to staff turnover and forced staffing economies. Discontinuation of the development of summer annuals bedding displays brought forth adverse public comment.

Applications for use of playing fields and equestrian facilities continued to increase and concerted maintenance attention to these areas became necessary. The movement of motor traffic in the park continued to be a problem in spite of the reduction in through traffic achieved in 1974-75 by the closure of the York Road gates and the installation of traffic control signals and associated directional traffic islands outside the park at the intersection of York Road and Darley Road. To alleviate problems resulting from the increased popularity of cycling in the park and the conflict developing between pedestrians, cyclists and motorists, approval was given for the construction of a 500-metre children's cycle track in the southwestern section of the park. Pond enlargement and cleaning and associated earthworks as a preliminary to landscaping and extension of facilities for adult cycling in the same area was commenced. Other improvements included extension of tree plantings, installation of timber parking-control barriers to protect lawn areas, kerbing and repainting of fencing.

Interest in and demand by all age groups for the facilities provided in Centennial Park continues to increase.

APPENDIX 1

ACCOUNTS OF DEPARTMENT OF AGRICULTURE FOR THE YEAR ENDED 1976-77

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings, equipment and permanent improvements to departmentally owned property is a charge on the General Loan Account.

In addition to these sources of funds, the Department is assisted in financing certain lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, Semi-Governmental and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of "Special Deposits" Accounts. The operations on some of the more significant Special Deposits Accounts are detailed in this report.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1975-76	1976-77	Increase (+) or Decrease (-)
	\$	\$	\$
Consolidated Revenue Fund	41,801,006	45,469,070	3,668,064 +
General Loan Account	1,067,836	1,129,000	61,164 +
Special Deposits Accounts	25,501,658	18,891,612	6,610,046 -
	\$ 68,370,500	65,489,682	2,880,818 -

CONSOLIDATED REVENUE FUND EXPENDITURE

Following are details of expenditure from Consolidated Revenue Fund for the previous two years:

Division	1975-76	1976-77	Increase (+) or Decrease (-)
	\$	\$	\$
Central Administration	8,216,797	8,301,528	84,731 +
Biological and Chemical Research Institute ..	2,059,614	2,368,809	309,195 +
Plant Industry	3,023,418	3,407,760	384,342 +
Horticulture	2,891,500	3,281,669	390,169 +
Dairying	1,698,825	1,606,179	92,646 -
Research Services	5,734,383	6,539,457	805,074 +
Agricultural Colleges	1,765,747	1,919,718	153,971 +
Animal Industry—			
Head and District Offices (a)	8,679,823	10,012,280	1,332,457 +
Queensland Border	720,045	792,758	72,713 +
Tick Quarantine Areas	5,430,122	5,496,138	66,016 +
Royal Botanic Gardens	1,580,732	1,742,774	162,042 +
	\$ 41,801,006	45,469,070	3,668,064 +

(a) Includes State contribution to National Bovine Tuberculosis and Brucellosis Eradication Campaign \$1,024,870.

The amount provided for the State contribution to Bovine Tuberculosis and Brucellosis campaign was transferred to Special Deposits Account, details of which are given later in this report.

GENERAL LOAN EXPENDITURE 1976-77

Cowra Agricultural Research Station—	\$
Laboratory/Administration Building	11,146
Glenfield Veterinary Research Station—	
Administration Building	20,995
Sewerage and drainage	112,531
Gosford Horticultural Research Station—	
Extensions for Australian Inoculant Research and Control Service	50,038
Grafton Agricultural Research Station—	
Chemical Laboratory	68,717
Seed Laboratory	48,965
Griffith Viticultural Research Station—	
Laboratory/Administration Building	66,794
Narrabri Agricultural Research Station—	
Laboratory Administration Building	5,854
Orange Agricultural Research Station—	
Laboratory Administration Building	750
Queensland Border—	
Cottage—Beebo	41,810
Cottage—Mingoola	43,484
Richmond Dairy Research Centre—	
Airconditioning	21,255
Royal Botanic Gardens—	
Cottage—Mt Tomah	11,969
Road Construction	65,114
Rydalmere Biological and Chemical Research Institute—	
Bulk Store	29,703
Insecticide Resistance Laboratory	32,468
Tamworth Agricultural Research Station—	
Laboratory extensions	154,060
Staff Amenities Building	28,721
Trangie Agricultural Research Station—	
Cottage—Mt Tomah	11,969
Fire Protection System	1,966
Glasshouse	35,469
Wool Laboratory modifications	4,919
Wagga Agricultural Research Institute—	
Extensions to Laboratory	31,606
Richland Park Machinery shed	21,100
Wagga Regional Veterinary Centre—	
Veterinary Laboratory	2,228
Wollongbar Agricultural Research Station—	
Cottage—Duck Creek	36,270
Glasshouse	5,978
Yanco Agricultural Research Centre—	
Development	135,015
	<u>1,129,000</u>

SPECIAL DEPOSITS ACCOUNTS

Transactions on some of the more significant Special Deposits Accounts during the year are given below:

COMMONWEALTH GRANTS FOR STATE SECONDARY SCHOOLS TECHNICAL TRAINING PROJECTS

These funds are made available by the Commonwealth under the States Grants (Technical Training) Acts. Works under the first triennium (1st July, 1965 to 30th June, 1968) were completed at a total cost of \$800,000, and works under the second triennium (1st July, 1968 to 30th June, 1971) were completed at a total cost of \$1,227,000. Works under the third triennium (1st July, 1971 to 30th June, 1974) are still in progress; \$2,546,486 has been spent to 30th June, 1977.

A summary of receipt and expenditure of funds under the third triennium is shown hereunder:

	\$	\$
Grant received from Commonwealth (including supplementation)		2,590,000
Previous expenditure to 30th June, 1976	2,497,599	
Expenditure during 1976-7—		
<i>C. B. Alexander Agricultural College</i>		
Accommodation, Lecture, Library Complex	48,887	2,546,486
Balance of funds available to complete third triennium		<u>43,514</u>

COMMONWEALTH GRANTS FOR COLLEGES OF ADVANCED EDUCATION

Commonwealth legislation provides for grants towards State expenditure on advanced education for courses of instruction which comply with the conditions laid down in the Commonwealth Acts. Until 31st December, 1973, grants were made for the following three purposes:

- (1) Financing of major capital projects on a \$1 for \$1 basis by Commonwealth and State.
- (2) Recurrent Expenditure (running costs). The Commonwealth contributes \$1 for every \$2.85 spent by the State.
- (3) Library purposes in the form of a direct grant from the Commonwealth.

Commencing on 1st January, 1974, Colleges of Advanced Education have been wholly financed by the Commonwealth Government, there being no further contributions by the State as set out in (1) and (2) above. However, the State was required to contribute 1/6th of the 1973-5 triennium Capital Works Programme.

Expenditure on the advanced education programmes is summarized as follows:

	\$	\$	\$
(1) <i>Major Capital Projects</i>			
<i>First Triennium</i> 1st January, 1967 to 31st December, 1969			
Total Expenditure first triennium			800,930
<i>Second Triennium</i> 1st January, 1970 to 31st December, 1972			
Total Expenditure second triennium			4,418,471
<i>Third Triennium</i> 1st January, 1973 to 31st December, 1975			
Expenditure to 30th June, 1976	4,304,156		
Expenditure 1976-7:			
<i>Hawkesbury Agricultural College</i>			
Food Technology Buildings	13,823		
Plant Science Building	1,916		
Ancillary Buildings	4,078		
Purchase of Equipment	34,976		
Field Services Building	18,081		
Union and Library Additions	11,656		
Electrical Reticulation	761		
<i>Orange Agricultural College</i>			
Student Accommodation	4,361		
Ancillary Buildings	66,286		
<i>Wagga Agricultural College</i>			
Purchase of Equipment	5,971		
Graham Block Extensions	1,580		
Animal and Plant Science Laboratory	23,727		
Engineering Extensions	11,374	198,590	
Total Third Triennium			4,502,746
<i>Annual Allocations—1976 onwards</i>			
Expenditure 1976-7:			
<i>Orange Agricultural College</i>			
Relocatable Classroom	15,678		
Purchase of Equipment	4,152	19,830	
Total expenditure to 30th June, 1976			9,741,977
(2) <i>Library Grants</i>			
<i>Hawkesbury Agricultural College</i>			
Expenditure to 30th June, 1976	50,435		
Expenditure 1976-7	Nil	50,435	
<i>Orange Agricultural College</i>			
Expenditure to 30th June, 1976	29,292		
Expenditure 1976-7	5,388	34,680	
<i>Wagga Agricultural College</i>			
Expenditure to 30th June, 1976	29,651		
Expenditure 1976-7	Nil	29,651	
		114,766	

AUSTRALIAN DEVELOPMENT ASSISTANCE BUREAU PROJECTS
WORKING ACCOUNT

During the 1976-7 financial year the Department became involved in the administration of various overseas aid projects in conjunction with the Australian Development Assistance Bureau.

The finance is provided by the Australian Development Assistance Bureau, and is used in the operation of the various projects. In addition, to providing technical advice and assistance, the projects will be managed in various countries by Departmental personnel recruited for this purpose.

Details of the operation of the Special Deposits Account are given below up to 30th June, 1977.

Receipts		\$167,000
<i>Less Expenditure</i>	\$	
Salaries and Allowances	8,645	
Travelling Expenses	35,704	
Motor Vehicle Running Costs	Nil	
Rent	Nil	
Equipment non-consumable	Nil	
Equipment consumable	Nil	
Overhead Expenses	2,576	46,925
Balance at 30th June, 1977		<u>\$120,075</u>

SWINE COMPENSATION FUND

Following is a summary of operations on the Swine Compensation Fund for year ended 30th June, 1977:

Balance in fund at 1st July, 1976		\$	1,032,960
Receipts—Interest			<u>92,625</u>
			1,125,585
	\$		
Payments—Compensation	5,485		
Administration Costs	3,800		
Research Costs	18,840	28,125	
			<u>\$1,097,460</u>

CATTLE COMPENSATION FUND

Balance as 1st July, 1976		2,213,172
Receipts—		
Levies	31,298	
Stamp duty	316,665	
Interest	148,000	
Commonwealth Subsidy—		
Tuberculosis Reactors	5,529	
Commonwealth Advance—		
Brucellosis campaign	640,000	1,141,492
		<u>3,354,664</u>
Payments—		
Compensations—		
National Tuberculosis	32,808	
National Brucellosis	13,782	
State Brucellosis	53,150	
State Tuberculosis	4,012	
State—Other diseases	1,932	
	105,684	
Administration Costs of Department of Agriculture	31,255	
Payable to Secretaries of Pasture Protection Boards	23,763	160,702
Balance in fund at 30th June, 1977		<u>\$3,193,962</u>

The following statistical information is supplied in connection with the compensation payments of \$105,684:

CATTLE COMPENSATION PAYMENTS 1975-76

	Number of claims				Number of animals				Payments			Total
	Reg. 5	Reg. 6	Section 5 (1) (e)	Total	Reg. 5	Reg. 6	Section 5 (1) (e)	Total	Reg. 5	Reg. 6	Section 5 (1) (e)	
									\$	\$	\$	\$
Brucellosis	11	..	88	99	307	..	2 126	2 433	13,782	..	53,782	66,932
Tuberculosis	107	43	..	150	464	53	..	517	32,808	4,012	..	36,820
Tick Fever	1	..	..	1	1	..	..	1	63	..	..	63
Trichomoniasis	1	..	..	1	20	..	..	20	562	..	..	562
Johnes Disease	8	..	..	8	15	..	..	15	1,307	..	..	1,307
	128	43	88	259	807	53	2 126	2 986	48,522	4,012	53,150	105,684

ERADICATION OF BOVINE TUBERCULOSIS AND BRUCELLOSIS— WORKING ACCOUNT

Balance in fund at 1st July, 1976		\$	284,568
<i>Income—</i>			
Contributions by New South Wales			1,024,870
Contributions by Commonwealth			2,895,000
<i>Expenditure—</i>			
Salaries, wages and associated charges ..		1,544,432	
Travelling expenses		53,654	
Vehicle running costs		12,098	
Printing and requisites		5,894	
Postage and telephone		6,723	
Freight and cartage		3,300	
Equipment and materials		66,675	
Costs of tail tags		7,671	
Payments to private practitioners—			
for tuberculosis testing	7,190		
for brucellosis testing	374,586	381,776	
Rentals of offices		30,335	
Administration costs		104,246	
Purchase of plant and motor vehicles ..		140,774	
Land, Buildings and improvements		118,200	2,475,778
Balance as at 30th June, 1977			1,728,660

Against the balance of \$1,728,660 quoted above, must be considered firm commitments of \$926,000 for Capital items and \$68,611 for other items, in total \$994,661.

AUSTRALIAN EXTENSION SERVICES GRANT

Name of Item or Project	Expenditure	
	\$ 1975-76	\$ 1976-77
Agronomy	287,443	363,501
Horticulture	122,769	137,529
Animal Industry	188,117	172,995
Dairying	105,032	103,787
Biometric Services	25,876	24,880
Extension Services	549,807	708,313
Engineering and Machinery Services	147,114	155,515
Agricultural Trainees	5,330	(151)
Publications	63,486	76,043
Library Services	23,718	56,443
(Conferences Study Tours—overseas	6,587	Nil
In-Service-Training	6,483	25,012
(Post Graduate Training	1,890	Nil
Economic and Marketing Services	224,500	277,577
Biological and Chemical Services	109,911	115,809
Buildings and other Major Developments	269,187	59,622
	<u>\$2,137,250</u>	<u>\$2,292,945</u>

AUSTRALIAN INOCULANTS RESEARCH AND CONTROL SERVICE—
WORKING ACCOUNT

Following is a statement of receipts and payments for the above account for the year ended 30th June, 1977:

	\$	\$
Balance at 1st July, 1976		18,748
Receipts—		
Contributions from—		
New South Wales	13,000	
Victoria	10,050	
Queensland	10,050	
South Australia	6,500	
Western Australia	17,140	
Tasmania	2,370	59,110
		<u>77,858</u>
Payments—		
Salaries	42,953	
Operating Expenses	1,659	44,612
Balance at 30th June, 1977		<u>\$33,246</u>

NOXIOUS INSECTS DESTRUCTION ACCOUNT

The Noxious Insects Act provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into a Special Deposits Account and applied by the Minister for purposes of the Act.

Following is a financial statement of the operations of this account during 1976-77 which included cost associated with plague locust as well as spur throated locust.

	\$	\$
Balance at 1st July, 1976		385,485
Receipts—		
Advance from N.S.W. State Treasury	250,000	
Levies	248,397	
Proceeds of Sale of Motor Vehicle	7,920	
Refund from Plague Locust Patrol Service	12,172	518,489
		<u>903,974</u>
Payments—		
Contribution to Australian Plague Locust Commission	162,500	
Equipment purchases	5,037	
Helicopter and Aircraft hire	75,572	
Insecticide purchases	427,354	
Maintenance/repair of equipment	3,554	
Materials and Sundry purchases	8,616	
Motor Vehicle Running Costs	14,448	
Purchase of Motor Vehicles	10,688	
Salaries	12,847	
Travelling expenses	8,157	728,773
Balance at 30th June, 1977		<u>\$175,201</u>

VETERINARY SURGEONS ACT

This Act provides for the establishment of a Board of Veterinary Surgeons for New South Wales. Fees and penalties collected are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Boards are met.

Below is a statement of receipts and payments for the year ended 30th June, 1977.

RECEIPTS		PAYMENTS	
	\$		\$
Roll Fees	22,950	<i>Administration</i>	
Registration Fees	403	Salaries	19,661
Restoration Fees	545	Members fees	1,565
Complaint Fees	100	Travelling expenses	894
Examination Fees (Debit)	(30)	Printing, Stationery	2,011
Excess of payment over receipts	3,418	Postage and Minor Equipment	855
		<i>Investigating Committee</i>	
		Chairmans fees	300
		Members travelling	463
		<i>Disciplinary Tribunal</i>	
		Legal Fees	1,055
		Witness Expenses	582
	<u>\$27,386</u>		<u>\$27,386</u>

MEAT INSPECTION SERVICE

The Meat Inspection Service is administered by virtue of the Meat Industry Act, which makes provision for a scale of fees. Following is a statement of receipts and costs associated with this service, for year ended 30th June, 1977.

	\$	\$
Receipts from inspection fees		5,298,132
<i>Less—</i>		
Salaries, wages and associated items	3,815,774	
Travelling expenses and motor vehicle running costs ..	254,872	
General stores, freight and cartage	25,150	
Books, periodicals and printing	2,468	
Rent, cleaning, phone, electricity and postage	8,166	
Laundry expenses	1,795	
Sundry expenses	280	
		<u>1,189,627</u>
Net gain on Meat Inspection Service		1,189,627

Overhead expenses of \$818,120 to cover Administration Charges, Workers Compensation Insurance Premiums, Payroll Tax and Employers Contribution to Superannuation Funds should also be taken into account.

When this amount is taken into account the overall net gain on the Meat Inspection Service is \$371,507.

FUND CREATED BY THE WHEAT MARKETING (BARRING OF CLAIMS) FUND
Revenue Account for year ended 30th June, 1977

	\$	\$
Interest on Investment (including Savings Bank Interest)		6,462
Commitments entered into during the year	3,167	
Transferred to Farrer Memorial Trust Fund	3,282	
Transfer of unutilized revenue to Accumulated Funds	11	
Bank charges	2	
		<u>6,462</u>

Balance Sheet as at 30th June, 1977

LIABILITIES		ASSETS	
	\$		\$
<i>Accumulated Fund—</i>		Investment in Government	
Balance 1st July, 1976..	108,413	Securities (face value)	106,000
Unutilized revenue of		Cash at Bank	1,914
1976-77	11	Interest accrued but not received ..	1,188
	<u>108,424</u>		
Commitments at 30th June,			
1977	678		
	<u>109,102</u>		<u>109,102</u>

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND

Year ended 30th June, 1977

Receipts for services rendered—

	\$	\$
Rents	89,860	
Student fees	179,382	
Fees—		
Witnesses and jurors	406	
Apiary Registrations	20,501	
Dairy Industry Act	552	
Farm Produce Agents	538	
Fertilizers Act	5,315	
Pest Destroyers Act	7,433	
Poultry Processing Act	1,890	
Stock Brands registration	19,401	
Stock Foods and Medicines Act	29,125	
Swine Brand Registrations	2,045	
Veterinary Surgeons Act	23,968	
Contribution from Commonwealth—		
for administration of plant quarantine	1,261,294	
for administrative of animal quarantine	371,037	
for administration of Commerce Act	314,797	
for maintenance of gardens at Admiralty House	46,710	
for export certification of livestock	48,403	
from CSIRO for cotton research	70,649	
Fees—		
Dipping	17,966	
Inspection—Plant Diseases Act	27,714	
Inspection—Meat Industry Act	5,298,132	
Herd Recording	303,777	
Seed Certification and testing	21,652	
Miscellaneous	88,951	
Administration Costs—Cattle Compensation Fund ..	31,255	
Administration Costs—Swine Compensation Fund	3,800	
Commission on premiums, collected	19,943	
Miscellaneous receipts for services rendered	214,194	
Total receipts for services rendered		8,520,690
<i>General Miscellaneous Receipts—</i>		
Rents (excluding land, buildings, premises)	27,946	
Fines and forfeitures (including bond liability)	12,954	
Interest	951	
Sale of farm produce	573,389	
Sale of Government Property	48,238	
Repayments to credit of previous years votes	244,296	
Transfer of part balances of Special Deposits Accounts no longer required	1,116	
Miscellaneous unclassified receipts	17,378	
Pastures Protection Boards 3 per cent contribution	175,358	
Employers liability to State Superannuation Fund	371,539	
Sale of Publications	6,414	
Total miscellaneous receipts		1,479,579
TOTAL—ALL RECEIPTS		\$10,000,269

APPENDIX II

PUBLICATIONS 1976-77

Publications are classified as: Department of Agriculture bulletins, booklets, leaflets; contributions to journals, including the Department's journals (the *Agricultural Gazette of N.S.W.*, the *Review of Marketing and Agricultural Economics*, *Dairy Topics*, *Poultry Notes*, and *Veterinary Notes*); papers presented at technical conferences for which there are published records; theses presented for higher degrees; and miscellaneous articles such as those appearing in industry journals.

This appendix does not include the many items published as news and information releases for press, radio and television, newspaper supplements and regional newsletters.

DIVISION OF ANIMAL INDUSTRY

Department of Agriculture Bulletins and Booklets

- Anon. (1975) Brucellosis can land the cattle producer and Australia in the red *National Brucellosis Eradication Campaign Pamphlet 1*
- Anon. (1975) Brucellosis in cattle *National Brucellosis Eradication Campaign Pamphlet 2*
- Anon. (1975) Malignant oedema in sheep *Bulletin AD 39*
- Anon. (1975) Lice and mange in pigs *Bulletin AD 51*
- Anon. (1976) Water for pigs *Bulletin A 20*
- Anon. (1976) Footrot in cattle *Bulletin AD 46*
- Anon. (1976) Enterotoxaemia in sheep *Bulletin AD 60*
- Anon. (1976) Worms in cattle *Bulletin AD 64*
- Anon. (1976) Worms in poultry *Poultry Disease Bulletin AD 103*
- Anon. (1976) Cattle lice *Bulletin AD 132*
- Barlow, R., Doyle, P., Sundstrom, B., Thompson, J. and Want, G. (1977) Crossbreeding beef cattle on the north coast of N.S.W.—early results of a long term project *AG bulletin No. 1*
- Clark, A. R. (1977) Drought management and feeding of sheep *Bulletin A 264*
- Gilchrist, P. T. (1976) Prolapse (eversion of the oviduct) *Poultry Disease Bulletin AD 100*
- Gilchrist, P. T. (1976) Spirochaetosis (fowl tick fever) *Poultry Disease Bulletin AD 104*
- Gilchrist, P. T. (1976) Salmonellosis in poultry *Poultry Disease Bulletin AD 86*
- Gilchrist, P. T. (1976) Marek's disease *Poultry Disease Bulletin AD 88*
- Gilchrist, P. T. (1976) Chronic respiratory disease *Poultry Disease Bulletin AD 89*
- Gilchrist, P. T. (1976) Fatty liver—haemorrhagic syndrome *Poultry Disease Bulletin AD 91*
- Gilchrist, P. T. (1976) Fatty liver and kidney syndrome *Poultry Disease Bulletin AD 92*
- Gilchrist, P. T. (1976) Infectious bronchitis *Poultry Disease Bulletin AD 94*
- Gilchrist, P. T. (1976) Avian encephalomyelitis *Poultry Disease Bulletin AD 95*
- Gilchrist, P. T. (1976) Infectious laryngotracheitis *Poultry Disease Bulletin AD 96*
- Gilchrist, P. T. (1976) Leucosis *Poultry Disease Bulletin AD 97*
- Gilchrist, P. T. (1976) Necrotic enteritis *Poultry Disease Bulletin AD 98*
- Gilchrist, P. T. (1976) Sinusitis in turkeys *Poultry Disease Bulletin AD 99*
- Gilchrist, P. T. (1976) Wet droppings and wet litter in poultry *Poultry Disease Bulletin AD 106*
- Gilchrist, P. T. (1976) Cannibalism *Poultry Disease Bulletin AD 108*
- Gilchrist, P. T. (1976) Avian tuberculosis *Poultry Disease Bulletin AD 109*
- Gilchrist, P. T. (1976) Fowl cholera *Poultry Disease Bulletin AD 111*
- Gilchrist, P. T. (1976) Fowl pox *Poultry Disease Bulletin AD 118*
- Gilchrist, P. T. (1976) Colibacillosis *Poultry Disease Bulletin AD 122*
- Gilchrist, P. T. (1976) Monilias (thrush) *Poultry Disease Bulletin AD 126*
- Gilchrist, P. T. (1976) Cage layer fatigue *Poultry Disease Bulletin AD 130*
- Gilchrist, P. T. (1976) Gangrenous dermatitis *Poultry Disease Bulletin AD 131*
- Gilchrist, P. T. (1976) External parasites of poultry *Poultry Disease Bulletin AD 132*
- Hunt, E. R. (1975) Brucellosis in cattle *Bulletin AD 53*
- Marbach, W. (1975) Common internal parasites of horses *Bulletin AD 15*
- Marbach, W. (1975) Skin diseases of horses *Bulletin AD 74*
- Mullen, J. D. (Division of Dairying) and Kaiser, A. G. (1976) Multiple suckling—A flexible sideline enterprise for dairy farms *Technical Bulletin 8*
- Nowland, W. J. (1975) Control of vermin on poultry farms *Bulletin A 283*
- Nowland, W. J. (1975) Squab raising *Bulletin A 74*
- Nowland, W. J. (1976) Geese raising *Bulletin A 73*
- Nowland, W. J. (1976) Duck production *Bulletin A 183*
- Palmer, W. A. (1976) Management of ethion-chlordimeform mixtures in dipping baths *Technical Bulletin 9*
- Palmer, W. A. and Lewis, I. J. (1976) Evaluation of a dipping interval of 21 days for eradication of the cattle tick, *Boophilus microplus* *Technical Bulletin 10*
- Randall, M. C. and Sheridan, A. K. (1977) 24th Random Sample Layer Test Final Report 1975-76
- Tucker, M. J. (1975) Spring versus autumn lambing in merinos *Bulletin A 131*

Contribution to Journals

- Acland, H. M. and Littlejohns, I. R. (1976) A heart disease that kills pigs *Agricultural Gazette of N.S.W.* **87** (5): 28
- Atkins, K. D. and Robards, G. E. (1976) Efficiency of growth and wool production of young Merino ewes from a flock selected for fertility *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 315
- Ayres, J. F. (1976) Superphosphate requirements of clover-ley farming—a review of recent research *Wool Technology and Sheep Breeding* **24**: 15
- Ayres, J. F., McFarlane, J. D. (University of N.S.W.), Osborne, G. J. and Corbin, E. (1977) Superphosphate requirements of clover-ley farming 2. The residual effects of topdressing *Australian Journal of Agricultural Research* **28**: 287
- Ayres, J. F., McManus, W. R. (University of N.S.W.) and McFarlane, J. D. (University of N.S.W.) (1976) The evaluation of forage nutritive quality by microdigestion *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 472
- Ayres, J. F., McFarlane, J. D. (University of N.S.W.), Gilmour, A. R. and McManus, W. R. (University of N.S.W.) (1977) Superphosphate requirements of clover-ley farming 1. The effects of topdressing on productivity in the ley phase *Australian Journal of Agricultural Research* **28**: 269
- Barlow, R. and Hodges, C. J. (1976) Reproductive performance of ewe lambs: genetic correlation with weaning weight and subsequent reproductive performance *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 231
- Bayfield, R. F. and Cole, E. R. (University of N.S.W.) (1976) Sulfenamides and sulfenamides II Interchange reactions of aromatic sulfenamides *Phosphorus and Sulfur* **1**: 19
- Bolla, G. K. (1976) Mechanical feather burning *Poultry Notes* July: 20
- Bootes, B. W. (1976) Feral pigs *Agricultural Gazette of N.S.W.* **87** (3): 51
- Brunskill, A. and Williams, J. D. (1977) The "homemaid" sheep handling unit *Agricultural Gazette of N.S.W.* **88** (2): 32
- Campbell, N. J. and Jackson, C. A. W. (1977) The occurrence of the intestinal fluke *Sphaeridiotrema globulus* in domestic ducks in New South Wales *Australian Veterinary Journal* **53**: 29
- Chaseling, P. D. (1976) New poultry equipment award *Poultry Notes* January: 10
- Chaseling, P. D. (1977) Weed seeds and their effects on poultry *Poultry Notes* April: 19
- Chick, B. F. and McCleary, B. V. (1977) The purification and properties of a Thiaminase I enzyme from Nardoo (*Marsilea drummondii*) *Phytochemistry* **16**: 207
- Clark, A. R. (1977) Drought—dry time or disaster *Agricultural Gazette of N.S.W.* **88** (2): 40
- Clark, A. R. (1977) Go way back *Agricultural Gazette of N.S.W.* **88** (3): 27
- Denyer, R. C. (1976) Chemical residues in meat *Agricultural Gazette of N.S.W.* **87** (4): 19
- Donnelly, F. (1977) Pizzle droppings of wethers *Agricultural Gazette of N.S.W.* **88** (2): 9
- Doughty, F. R. (1977) Incidence of neurofibroma in cattle in abattoirs in New South Wales *Australian Veterinary Journal* **53**: 280
- Dunne, A. J. (1976) Wasted skins are wasted money *Agricultural Gazette of N.S.W.* **87** (6): 38
- Dunne, A. J. and Makeham, J. P. (University of New England) (1976) Lot feeding of lambs—physical and economic considerations *Agricultural Gazette of N.S.W.* **87** (4): 38
- Ferguson, B. D., Halloran, W. J. O. and Plant, J. W. (1977) Clover disease in sheep in N.S.W. *Agricultural Gazette of N.S.W.* **88** (3): 15
- Freer, R. E. (1977) Freeze branding of horses *Agricultural Gazette of N.S.W.* **88** (2): 18
- Fuller, D. K. (1976) Self feeding pigs *Agricultural Gazette of N.S.W.* **87** (5): 3
- Gaden, E. D. with Carroll, S. N. (Veterinary Inspector) and Wheatley, W. M. (1977) Preventing bloat and pulpy kidney in beef cattle *Agricultural Gazette of N.S.W.* **88** (3): 20
- Gard, G. P., Marshall, I. D. (Australian National University), Walker, K. H., Acland, Helen M. and de Sarem, W. G. (1977) Association of Australian arboviruses with nervous diseases in horses *Australian Veterinary Journal* **53**: 61
- Gee, C. D. (1976) A brain defect of newborn calves *Agricultural Gazette of N.S.W.* **87** (5): 33
- Glastonbury, J. R. W. (1977) Why piglets die before weaning *Agricultural Gazette of N.S.W.* **88** (2): 34
- Glastonbury, J. R. W. (1977) Prewaning mortality in the pig—pathological findings in piglets dying before and during parturition *Australian Veterinary Journal* **53**: 282
- Hall, D. G. and Hennessy, D. W. (1976) The digestibility of summer growing grasses estimated by three techniques *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 735
- Hall, C. A. and Campbell, N. J. with Whitlock, H. V., Thompson, H. G. and Martin, I. C. A. (University of Sydney) (1977) The effect of route of administration on the anthelmintic efficacy of benzimidazole anthelmintics in sheep infected with strains of *Haemonchus contortus* and *Trichostrongylus colubriformis* resistant or susceptible to thiabendazole *Research in Veterinary Science* **22**: 161
- Healey, J. S. (1976) Three cheers for animal health *Agricultural Gazette of N.S.W.* **87** (4): 12
- Healey, J. S. (1976) Livestock health *Agricultural Gazette of N.S.W.* **87** (4): 22
- Healey, J. S. (1976) Livestock health *Agricultural Gazette of N.S.W.* **87** (6): 34
- Healy, P. J. and Cole, A. E. (1976) Heterozygotes for mannosidosis in Angus and Murray Grey cattle *Australian Veterinary Journal* **52**: 385
- Hearnshaw, H. (1976) Synchronisation of oestrus and subsequent fertility in cattle, using the prostaglandin F₂ analogue, ICI 80996 (Cloprostenol) *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 437
- Hennessy, D. W. and Williamson, P. J. (1976) The nutritive value of kikuyu grass (*Pennisetum clandestinum*) leaf and the use of pelleted leaf in rations high or low in energy *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 729
- Hoare, R. J. T. (1977) Cloxacillin and veterinary medicine. A report of the Australian Veterinary Association sub-committee on mastitis *Australian Veterinary Journal* **53**: 245
- Hoare, R. J. T. (1976) Culling for mastitis *Dairy Topics* **12**: 9
- Horn, R. G. (1977) Low cost incinerator for disposal of dead birds *Poultry Notes* April: 8

- Horn, R. G. and Sanders, J. (1977) Some performance figures for force moulted flocks *Poultry Notes* January: 20
- Husband, A. J. and Watson, D. L. (1977) Immunological events in the popliteal lymph node of sheep following injection of live or killed *Corynebacterium ovis* into an afferent popliteal lymphatic duct *Research in Veterinary Science* 22: 105
- Jackson, C. A. W., Sinkovic, B. (University of Sydney), Webster, A. C. (Private Industry), and van der Kooi, K. (Private Industry) (1976) Field trials with lyophilised herpesvirus of turkeys vaccine against Marek's disease in layer and broiler rearing flocks *Australian Veterinary Journal* 52: 582
- Jackson, R. (1977) Will it rain next month? *Agricultural Gazette of N.S.W.* 88 (3): 32
- Jeffery, H. J. (1976) Effect of the liveweight of caged sheep and the amount of feed on offer on estimates of digestibility and ad libitum intake *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 656
- Jeffery, H. J., Buesnel, R. J. and O'Neill, G. H. (1976) Short-term studies on the response of grazing dairy cows to dietary supplementation *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 445
- Jeffrey, H. (1977) The computer and the farmer—a new combination *Agricultural Gazette of N.S.W.* 88 (2): 28
- Jessep, T. M. (1976) Beef measles are on the increase *Agricultural Gazette of N.S.W.* 87 (4): 11
- Kaiser, A. G. (1977) The use of colostrum preserved with formalin for rearing calves *Australian Journal of Experimental Agriculture and Animal Husbandry* 17: 221
- Keys, M. J. (1976) Close up those sheds *Poultry Notes* July: 20
- Keys, M. J. and McMahon, P. J. (1976) The latest on lighting *Poultry Notes* October: 3
- Kilgour, R. J. and King, H. (CSIRO) (1976) A technique to count mounts during mating in sheep using a meter harnessed to rams *Theriogenology* 6 (6): 611
- Killeen, I. D. (1976) The effects of age of egg and site of transfer on survival of transferred eggs in the ewe *Theriogenology* 6 (6): 637
- Lee, G. J. with McManus, W. R. (University of N.S.W.), and Robinson, V. N. E. (1977) Microlesions on rumen papillae of grain fed sheep *Research in Veterinary Science* 22 (2): 135
- Littlejohns, I. R. and Cottew, G. S. (CSIRO) (1977) The isolation and identification of *Mycoplasma mycoides* subsp. *capri* from goats in Australia *Australian Veterinary Journal* 53: 297
- Littlejohn, I. (1976) Solving the wet dropping problem *Poultry Notes* October: 13
- Luff, A. F. (1976) Mulesing sheep saves losses from flystrike *Agricultural Gazette of N.S.W.* 87 (4): 32
- McBarron, E. J. and Bryant, A. C. (Private Industry) (1977) The wandering jew plant can poison cattle *Agricultural Gazette of N.S.W.* 88 (3): 3
- McBarron, E. J. and Clark, F. L. (Veterinary Inspector Armidale) (1976) *Panicum laevifolium*—a problem grass *Agricultural Gazette of N.S.W.* 87 (5): 29
- Machin, M. V. and Dingle, J. H. P. (1977) Ultra-violet determination of chlorphenamide in cattle dipping baths and sprays *Journal of the Association of Official Analytical Chemists* 60: 696
- Macindoe, R. N. (1977) First Australian poultry and stock feed convention—summary of developments in poultry nutrition *Poultry Notes* April: 1
- Mitchell, T. D. (1976) Jetting made easier *Agricultural Gazette of N.S.W.* 87 (5): 45
- Mitchell, T. (1977) Range goat production *Agricultural Gazette of N.S.W.* 88 (2): 2
- Mitchell, T. (1977) Angora goats *Agricultural Gazette of N.S.W.* 88 (2): 5
- Mulholland, J. G., Coombe, J. B. (CSIRO), and Dann, P. R. (1976) Use of oat, lupin and field pea stubbles by grazing sheep *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 467
- Mulholland, J. G., Coombe, J. B. (CSIRO), Freer, M. and McManus, W. R. (University of N.S.W.) (1976) An evaluation of cereal stubbles for sheep production *Australian Journal of Agricultural Research* 27: 881
- Mulholland, J. G., Coombe, J. B. (CSIRO), and McManus, W. R. (University of N.S.W.) (1977) Diet selection and intake by sheep and cattle grazing together on stubbles of wheat, oats or barley *Australian Journal of Experimental Agriculture and Animal Husbandry* 17: 224
- Nowland, W. J. (1977) Incentive schemes for the broiler industry *Poultry Notes* April: 13
- Nowland, W. J., Pym, R. A. E. and Ferguson, J. (1976) Random sample broiler test *Poultry Notes* July: 8
- Palmer, W. A., Treverrow, N. L. and O'Neill, G. H. (1976) Factors affecting the detection of infestations of *Boophilus microplus* in tick control programs *Australian Veterinary Journal* 52: 321
- Palmer, W. A., Dingle, J. H. P. and O'Neill, G. H. (1977) Residues of dioxathion in adipose tissue of cattle subjected to multiple dippings *Australian Journal of Experimental Agriculture and Animal Husbandry* 17: 20
- Palmer, W. A., Dingle, J. H. P. and Heath, A. B. (1977) Residues of chlordimeform in bovine tissues and milk following application by a handspray *Australian Journal of Experimental Agriculture and Animal Husbandry* 17: 380
- Plant, J. W., Claxton, P. D., Jakovljevic, D. and de Saram, W. (1977) Brucellosis in the bull *Agricultural Gazette of N.S.W.* 88 (2): 45
- Plant, J. W. with Ferguson, B. D. and O'Halloran, W. J. (1976) Sub-clover causing ewe infertility *Agricultural Gazette of N.S.W.* 87 (3): 63
- Pritchard, D. P., Chick, B. F. and Connole, M. D. (Animal Research Institute, Yeerongpilly, Queensland) (1977) Eumycotic mycetoma due to *Drechslera rostrata* infection in a cow *Australian Veterinary Journal* 53: 241
- Pym, R. A. E. and Farrell, D. J. (University of New England) (1977) A comparison of the energy and nitrogen metabolism of broilers selected for increased growth rate, food consumption and conversion of food to gain *British Poultry Science* 18: 411
- Restall, B. J., Brown, G. H., Blockey, M. de., Cahill, L. (Department of Agriculture, Victoria) and Kearins, R. (1976) Assessment of reproductive wastage in sheep 1. Fertilization failure and early embryonic survival *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 329

- Restall, B. J. and Griffith, D. A. (CSIRO) (1976) Assessment of reproductive wastage in sheep 2. Interpretation of data concerning embryonic mortality *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 336
- Restall, B. J., Herdegen, J. and Carberry, P. (1976) Induction of parturition in sheep using oestradiol benzoate *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 462
- Restall, B. J., Wilkins, J., Kilgour, R., Tyrrell, R. N. and Hearnshaw, H. (1976) Assessment of reproductive wastage in sheep 3. An investigation of a commercial sheep flock *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 344
- Restall, B. J., Kearins, R. D. and Starr, B. G. (1977) Studies of pituitary function in lactating ewes *Journal of Reproduction Fertility* **49**: 291
- Restall, B. J. and Starr, B. G. (1977) The influence of season of lambing and lactation on reproductive activity and plasma LH concentrations in Merino ewes *Journal of Reproduction Fertility* **49**: 297
- Robards, G. E., Davis, C. H. and Saville, D. G. (1976) Skin folds and Merino breeding 9. Efficiency of conversion of food to wool *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 361
- Saunders, G. R. (1977) Control of rats and mice *Agricultural Gazette of N.S.W.* **88** (1): 23
- Sheldrake, R. F. and Hoare, R. J. T. (1977) The new M.A.S. docket *Dairy Topics* **13**: 13
- Sheridan, A. K. and Randall, M. C. (1977) Heterosis for egg production in White Leghorn Australorp crosses *British Poultry Science* **18**: 69
- Slennett, G. D. (1976) A graphic picture of the egg situation in N.S.W. *Poultry Notes* July: 2
- Slennett, G. D. (1977) First Australasian poultry and stock feed convention—summary of management papers *Poultry Notes* January: 3
- Speers, P. J. (1976) A guide to better beef production *Agricultural Gazette of N.S.W.* **87** (4): 8
- Sundstrom, B. (1976) Sugar cane—potential as cattle feed *Agricultural Gazette of N.S.W.* **87** (5): 8
- Thompson, J. M., Pattie, W. A. (University of Queensland) and Butterfield, R. M. (University of Sydney) (1977) An evaluation of the "Scanogram" as an ultrasonic aid in assessing carcass composition of live sheep *Australian Journal of Experimental Agriculture and Animal Husbandry* **17**: 251
- Tyrrell, R. N. (1976) Some effects of pregnancy in eight-month-old Merino ewes *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 458
- Tyrrell, R. N. (1976) Sheepfarming in Iceland—a lesson for us *Agricultural Gazette of N.S.W.* **87** (4): 2
- Walker, K. H., Acland, Helen M., Cole, A. E. and Seaman, J. (1977) Typical colobomata in cattle *Australian Veterinary Practitioner* **7**: 25
- Williams, J. D. and Brunskill, B. (1977) Crutching cradles are effective *Agricultural Gazette of N.S.W.* **88** (3): 6
- Worthington, C. A. and Kennedy, J. P. (University of N.S.W.) (1976) Primordial follicles in the ovary of the neonatal ewe lamb *Proceedings of the Australian Society for Reproductive Biology Journal of Reproduction and Fertility* **46**: 514
- Killeen, I. D. *et al.* (1976) Ovulation rate in high fecundity Merino crosses *Theriogenology* **6** (6): 622

Contributions to Technical Conferences

- Atkins, K. D. and McGuirk, B. J. (1976) Genetic improvements of fertility and fly resistance *Proceedings of the International Sheep Breeding Congress* Perth p. 271
- Atkins, K. D. (1977) The "D" flock research programme *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 17
- Baillie, B. G. (1977) Mulesing and tail length trial with first cross ewes *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 16
- Barlow, R. and O'Neill, G. H. (1977) Postweaning gain of heifers in a subtropical environment: genotype x nutrition interacting *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* part 8-1
- Beck, R. J. (1976) The physical movement of meat *N.S.W. Department of Agriculture Meat Marketing Workshop* Orange p. 18
- Beck, R. J. (1976) The distribution and numbers of beef cattle, sheep and horses in Australia *Australian Development Assistance Bureau International Training Course in Animal Quarantine* Sydney p. 26
- Beck, R. J. and Manwaring, J. F. (1976) An initial examination of helping farmers help themselves *N.S.W. Department of Agriculture Report on the Meat Marketing Workshop* Orange
- Bennett, N. W. (1977) Fleece measurement services for the N.S.W. Merino industry *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 28
- Cahill, J. R. (1977) Merino competitions—their use in evaluating merino strains under district conditions *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 19
- Campbell, N. J., Kelly, N. J. (University of Sydney) and Dineen, J. K. (CSIRO) (1976) The effect of route of infection on the development of *Fasciola hepatica* in the rat and its relationship to age resistance *Proceedings of Australian Society of Parasitology* Melbourne p. 10
- Claxton, P. D., Hyne, R. H. J. (University of Sydney) and Barton, Mary D. (Veterinary Research Institute, Parkville) (1976) Brucellosis as an occupational hazard in Australia *N.S.W. Veterinary Proceedings* **12**: 52
- Clements, B. W. (1977) Terminal sire comparison—a review of latest knowledge *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 11
- Dawe, S. T. (1977) Intensive lamb rearing *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 12
- Denny, G. (1977) Increasing sheep fertility with lupin grain supplementation *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 25
- Dicker, R. W. and Barlow, R. (1977) The relative infestation levels of the bush tick in Zebu x European heifers *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* part 7-1

- Donnelly, F. B. (1977) Crossing merino strains *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 18
- Falk, R. H. (1976) Some practical aspects of copper deficiency in N.S.W. *N.S.W. Veterinary Proceedings* 12: 38
- Ferguson, B. D. (1977) Clover induced infertility of ewes in the southern N.S.W. Wheatbelt—the problem defined *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 23
- Fogarty, N. M. (1977) Inherent susceptibility to pneumonia in Border Leicester sheep *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* part 7-8
- Fogarty, N. M. (1977) Australian Dorset Horn—inbreeding *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 22
- Freer, R. E. (1976) Management of synchronisation programmes *Proceedings of a Symposium on Evaluation of Practical Techniques for Synchronisation of Oestrus in Cattle with Prostaglandins* Sydney p. 115
- Gilchrist, P. T., Curtin, P., Bagust, T. and Dennett, D. (1976) Serological survey of the poultry industry in the Sydney and Newcastle areas *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 224
- Gilchrist, P. T. (1976) The consequences of an outbreak of Newcastle disease *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 293
- Gilchrist, P. T. (1977) Proventriculitis in poultry *Proceedings of the 54th Annual Conference of the Australian Veterinary Association* Perth p. 155
- Gleeson, A. R. (1977) Review of development in sheep and wool production research by N.S.W. Department of Agriculture—including role of Standing Committee and Animal Production Committee *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 7
- Hall, C. G. (1977) New research in blowfly strike control *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 14
- Hammond, K. (1977) Organisation in Animal Breeding *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* part 4-1
- Harris, D. C. (1977) Classification—the extension task *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 6
- Healy, P. J. (1976) Mannosidosis in cattle *Proceedings of the 59th Annual Conference of the Association of Veterinary Inspectors of N.S.W.* Sydney p. 39
- Hearnshaw, H. (1976) Synchronisation of oestrus and fertility using a prostaglandin $F_{2\alpha}$ analogue, ICI 80996 (cloprostenol), in research and commercial beef herds in N.S.W. *Proceedings of a Symposium on Evaluation of Practical Techniques for Synchronisation of Oestrus in Cattle with Prostaglandins* Sydney p. 64
- Hoare, R. J. T., Benson, R. J. and Calder, B. O. E. (1976) Mastitis Control programme—economic benefits and extension implications *Proceedings 20th World Veterinary Congress* Thessaloniki 3: 1991
- Hoare, R. J. T. and Sheldrake, R. F. (1976) Progress towards mastitis control *N.S.W. Veterinary Proceedings* 12: 50
- Horn, R. G. (1976) Improved laying performance and its effect on economic return *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 275
- Jackson, C. A. W. (1976) Poultry diseases in Australia—problems and economic significance *Proceedings International Course in Poultry Husbandry Australian Development Assistance Agency Seven Hills* p. 1
- Jackson, C. A. W. (1976) Egg transmitted diseases of poultry *Proceedings of the International Course in Poultry Husbandry, Australian Development Assistance Agency Seven Hills* p. 19
- Jackson, C. A. W., with Choi, C. O. (University of Sydney) and Sinkovic, B. (University of Sydney) (1977) Development of neutralising antibodies to turkey herpesvirus (HVT) in chickens with and without homologous maternal antibody *Proceedings of the 54th Annual Conference of the Australian Veterinary Association* Perth p. 148
- Jackson, C. A. W., Sinkovic, B. (University of Sydney) and Choi, C. O. (University of Sydney) (1977) Infectivity and immunogenicity of apathogenic and attenuated Marek's disease virus vaccines *Proceedings of the 54th Annual Conference of the Australian Veterinary Association* Perth p. 149
- Kajons, A. (1977) Carpet wool sheep in Australia *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 20
- Keys, M. J. (1976) Use of dehydrated poultry manure as a stockfeed ingredient *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 334
- Kilgour, R. J. and King, H. (CSIRO) (1976) A technique to count mounts during flock mating in sheep using a meter harnessed to rams *Proceedings of the Australian Society for Reproductive Biology* Abstract No. 15
- Killeen, I. D. (1976) The effects of age of egg and site of transfer on survival of transferred eggs in the ewe *Proceedings of the Australian Society for Reproductive Biology* Abstract No. 40
- Littleton, I. I. and Pym, R. A. E. (1976) The effect of furazolidone and zoalene on weight gain and feed efficiency of broilers *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 324
- McGuirk, B. J. and Atkins, K. D. (1976) Responses to selection for increased fleece weight in Merino sheep *Proceedings of the International Sheep Breeding Congress* p. 100
- McGuirk, B. J. and Savage, P. H. (Australian Wool Corporation) (1976) Factors influencing the efficiency with which Merino studs select for increased wool production *Proceedings of the International Sheep Breeding Congress* p. 165
- McGuirk, B. J. (1977) Heterosis in crosses between sheep breeds *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* Part 6-19
- McGuirk, B. J. (1977) The role of objective measurement in Merino breeding schemes *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 25
- Macindoe, R. N. (1976) The case for family farms in the Australian poultry industry *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 399

- McMahon, P. J., Robinson, D. and Armstrong, J. P. (1976). Egg shell meal as a calcium source for laying hens *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 372
- Mangelsdorf, N. W. (1977) Clover induced infertility of ewes in the southern N.S.W. Wheatbelt—extension action *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 24
- Mitchell, T. D. (1977) Chemical mulesing *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 15
- Mitchell, T. D. (1977) Electric fencing for lamb protection *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 21
- Phillips, K. R., Keogh, J. B. and Chambers, S. (1977) Genetic progress in milk and butterfat yield in the artificially bred and herd recorded dairy cattle populations in New South Wales *Proceedings of the 3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* Part 4-9
- Piper, L. R., Allison, A. J., Bindon, B. M., Gherardi, P., Kelly, R. W., Killeen, I. D., Lindsay, D. R., Oldham, C., Robertson, D. and Stevenson, J. R. (1976) Ovulation rate in high fecundity Merino crosses *Proceedings of the Australian Society for Reproductive Biology* Abstract No. 26
- Plant, J. W. with Carroll, S. N. (Veterinary Inspector, Yass) (1976) Clover Disease in sheep on the Southern Tablelands of New South Wales *N.S.W. Veterinary Proceedings* 12: 39
- Plant, J. W., Moyle, G. G. (University of Sydney) and Jelbart, R. A. (1976) Causes of infertility in Dorset stud flocks in New South Wales *N.S.W. Veterinary Proceedings* 12: 42
- Plant, J. W. (1977) Field investigation of perinatal lamb mortalities *Proceedings of the 54th Annual Conference of the Australian Veterinary Association* Perth p. 157
- Pym, R. A. E. and Farrell, D. J. (1976) Energy and nitrogen metabolism in selected lines of broiler chickens *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 190
- Pym, R. A. E., Gilbert, W. S. and Singh, D. (1976) The effect of Dichlorvos as a contaminant in the feed on the performance of laying hens *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 313
- Roberts, H. B. (1976) Presidential address to annual general meeting, N.S.W. Division of the Australian Veterinary Association *N.S.W. Veterinary Proceedings* 12: 7
- Robinson, D. and Dettmann, E. B. (1976) Controlled feeding of laying stock—interaction with strain factors and nutritional management in the rearing period *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 166
- Robinson, D. and Mohr, G. (1976) Cage design for laying birds at high stocking densities *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 269
- Sheridan, A. K., Howlett, C. R. (University of N.S.W.) and Dettmann, E. B. (1976) Selection for tibial dyschondroplasia in Australian meat chickens *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 176
- Slennett, G. D. (1976) Getting value from Australian poultry research *Proceedings of the 1st Australasian Poultry and Stock Feed Convention* Melbourne p. 390
- Smeal, M. G. (1976) Anthelmintics and parasite control programmes for cattle *N.S.W. Veterinary Proceedings* 12: 15
- Tyrrell, R. N., Gleeson, A. R., Ferguson, B. D., O'Halloran, W. J. and Kilgour, R. J. (1976) Evidence and confirmation of late embryo loss in a flock of Merino ewes *Proceedings of the International Sheep Breeding Congress* p. 411
- Watts, R. M. (1977) Veterinary research in the New South Wales Department of Agriculture *Proceedings of the 54th Annual Conference of the Australian Veterinary Association* Perth p. 31
- Wilson, B. R. (1977) Extension and the proposed National Pig Carcase Measurement and Information Service *Department of Agriculture N.S.W. Sheep and Wool Seminar* Dubbo: Paper 3

Post Graduate Theses

- Fogarty, N. M. (1977) *Breed structure and genetic analysis of the Dorset Horn breed in Australia* M.Sc. thesis University of N.S.W.
- Glastonbury, J. R. W. (1976) *Prewaning mortality in the pig A statistical and pathological study* M.V.Sc. thesis University of Sydney.
- Greer, E. B. (1977) *Mineral and vitamin supplementation of diets for growing pigs* M.Sc. thesis University of Sydney.
- Martin, J. (1977) *The ecology of the wild rabbit (Oryctolagus cuniculus) at three locations in a semi arid environment* M.Sc. thesis University of Sydney
- Webb, R. F. (1976) *Investigations into Histophilus ovis* M.V.Sc. thesis University of Sydney

Books

- Atkins, K. D. and Fogarty, N. M. (1976) Breeding for wool and meat—genetic principles: chapter 3 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Barwick, S. A. and Thompson, J. M. (1976) Meat production and carcase quality: chapter 9 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Cole, A. E. (1976) Flock health: chapter 10 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Davis, C. H. (1976) Nutrition—drought, production and supplementary feeding: chapter 11 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Fowler, D. G. (1976) Reproduction in the ram: chapter 4 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Gleeson, A. R. and Jackson, R. (1976) Ultimate aim—optimum wool and meat production: chapter 14 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Godlee, A. C. (1976) The sheep situation in Australia and overseas: chapter 1 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Holst, P. J. and Killeen, I. D. (1976) Pregnancy and lambing: chapter 6 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)

- McBarron, E. J. (1977) *Medical and Veterinary Aspects of Plant Poisons in New South Wales* (New South Wales Department of Agriculture, Sydney)
- McGuirk, B. J. (1976) Flock improvement and breeding plans: chapter 13 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Restall, B. J. (1976) Reproduction in the ewe: chapter 5 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Robards, G. E. (1976) Grazing management: chapter 12 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Tucker, M. J. (1976) Lamb and weaner growth: chapter 7 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)
- Williams, A. J. (1976) Wool production: chapter 8 in *Sheep Production Guide* edited by V. G. Cole (Graziers' Association of N.S.W., Sydney)

Other Publications

- Anon. (1976) Beelines *The Australasian Beekeeper* 78 (1): 23; (2): 45; (3): 71; (4): 94; (5): 117; (6): 140.
- Anon. (1977) Beelines *The Australasian Beekeeper* 78 (7): 162; (8): 187; (9): 209; (10): 231; (11): 252; (12): 270
- Bolla, G. K. (1976) Watch out for mouldy feed *C.C.A.R.E.C. Rural Newsletter* 59: 20
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Bundy *The Australasian Beekeeper* 78 (1): 19
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Apple Box *The Australasian Beekeeper* 78 (2): 40
- Clemson, A. A. (1976) New Pender 48 frame radial extractor *The Australasian Beekeeper* 78 (2): 50
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Brittle Gum *The Australasian Beekeeper* 78 (3): 65
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Dandelions *The Australasian Beekeeper* 78 (4): 90
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Turpentine *The Australasian Beekeeper* 78 (5): 111
- Clemson, A. A. (1976) Honey and pollen plants of N.S.W.—Yellow Bloodwood *The Australasian Beekeeper* 78 (6): 136
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—Smooth Barked Apple *The Australasian Beekeeper* 78 (7): 158
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—White Clover *The Australasian Beekeeper* 78 (8): 183
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—Silverleaf Ironbark *The Australasian Beekeeper* 78 (9): 204
- Clemson, A. A. (1977) Outbreak of serious brood diseases—Hills District *The Australasian Beekeeper* 78 (8): 194
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—Darling Pea *The Australasian Beekeeper* 78 (10): 228
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—Small Fruited Grey Gum *The Australasian Beekeeper* 78 (11): 247
- Clemson, A. A. (1977) Honey and pollen plants of N.S.W.—Caleys Ironbark *The Australasian Beekeeper* 78 (12): 268
- Clemson, A. A. (1977) Advanced bee breeding school *The Australasian Beekeeper* 78 (8): 177
- Greer, E. B. (1977) What minerals and vitamins for growing pigs *The Pig Farmer* 11: 491
- Hoare, R. J. T. and Sheldrake, R. F. (1976) Subclinical mastitis appears widespread *N.S.W. Dairyman* 44: 7
- Jones, W. (1976) Plague locusts N.S.W. *The Australasian Beekeeper* 78 (3): 78
- Jones, W. (1976) Bee pollination demonstration *The Australasian Beekeeper* 78 (5): 122
- Korn, T. J. (1976) Beef cattle cross breeding research *I.R.E.C. Farmers Newsletter* 99: 22
- Korn, T. J. (1977) Rice by-products utilisation by ruminants *I.R.E.C. Farmers Newsletter* 101: 25
- Plant, J. W. and Marchant, R. S. (1976) Hairy lambs *Macquarie Rural Newsletter* 4 (2): 18
- Roese, G. J. (1976) Weaning Piglets *I.R.E.C. Farmers Newsletters* 99: 28
- Roese, G. J. (1977) Rice pollard, a by-product of the rice milling process, proves its worth in pig growing rations *The Australian Pig Bulletin* 26: 22
- Roese, G. J. (1977) Fat is no longer fashionable *I.R.E.C. Farmers Newsletter* 101: 7
- Ryan, D. M. (1976) Wheat in drought feeding programme *Hard and Soft Wheat Newsletter* (August) 8
- Sheldrake, R. F. and Hoare, R. J. T. (1976) Chlorine dips *N.S.W. Dairyman* 43: 4
- Sheldrake, R. F. and Hoare, R. J. T. (1977) Developments in the Mastitis Advisory Service *N.S.W. Dairyman* 50: 6
- Ward, B. A. (1977) C.A.A. Branch exhibits impressive *The Australasian Beekeeper* 78 (9): 214

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE BIOLOGY BRANCH

Department of Agriculture Bulletins and Booklets

- Anon. (1976) Bitter pit in apples *Department of Agriculture Biology Branch Bulletin* PD 2C
- Anon. (1976) Sooty blotch and flyspeck *Department of Agriculture Biology Branch Bulletin* PD 126C
- Anon. (1976) Septoria spot of citrus *Department of Agriculture Biology Branch Bulletin* PD 126C
- Anon. (1976) Fleck of pear and quince *Department of Agriculture Biology Branch Bulletin* PD 131C

- Anon. (1976) Lichens *Department of Agriculture Biology Branch Bulletin PD 135C*
- Anon. (1976) Damping off of seedlings *Department of Agriculture Biology Branch Bulletin PD 172C*
- Anon. (1976) Leaf spot of beetroot and silver beet *Department of Agriculture Biology Branch Bulletin PD 206C*
- Anon. (1976) Cereal cyst nematode *Department of Agriculture Biology Branch Bulletin PD 207C*
- Anon. (1976) Cucurbit diseases *Department of Agriculture Biology Branch Bulletin PD 86* (7th edition)
- Anon. (1976) Diseases of beet *Department of Agriculture Biology Branch Bulletin PD 94* (4th edition)
- Anon. (1976) Diseases of carrots *Department of Agriculture Biology Branch Bulletin PD 106* (7th edition)
- Anon. (1976) Soil treatment in the nursery *Department of Agriculture Biology Branch Bulletin PD 172* (2nd edition)
- Anon. (1977) Diseases of crucifers *Department of Agriculture Biology Branch Bulletin PD 87* (5th edition)
- Anon. (1977) Rhizoctonia disease *Department of Agriculture Biology Branch Bulletin PD 168C* (2nd edition)
- Anon. (1977) Lemon scab *Department of Agriculture Biology Branch Bulletin PD 182C* (3rd edition)
- Anon. (1977) Bitter rot of apple *Department of Agriculture Biology Branch Bulletin PD 185C* (2nd edition)
- Anon. (1977) Black rot of crucifers *Department of Agriculture Biology Branch Bulletin PD 188C* (2nd edition)
- Anon. (1977) Club root of crucifers *Department of Agriculture Biology Branch Bulletin PD 190 C* (2nd edition)
- Anon. (1977) Black spot of the grape vine *Department of Agriculture Biology Branch Bulletin PD 191C* (2nd edition)
- Anon. (1977) Four fungal leaf spots of strawberries *Department of Agriculture Biology Branch Bulletin PD 192C* (2nd edition)
- Anon. (1977) Brown rot *Department of Agriculture Biology Branch Bulletin PD 4C* (3rd edition)
- Anon. (1977) Citrus black spot *Department of Agriculture Biology Branch Bulletin PD 11C* (2nd edition)
- Anon. (1977) Early blight of tomato *Department of Agriculture Biology Branch Bulletin PD 122C* (2nd edition)
- Anon. (1977) Two virus diseases of Cymbidium orchids *Department of Agriculture Biology Branch Bulletin PD 143C* (2nd edition)
- Anon. (1977) Apple scab *Department of Agriculture Biology Branch Bulletin PD 163C* (2nd edition)
- Anon. (1977) Dead arm of grapes *Department of Agriculture Biology Branch Bulletin PD 164C* (2nd edition)
- Anon. (1977) Powdery mildew of cucurbits *Department of Agriculture Biology Branch Bulletin PD 165C* (2nd edition)
- Anon. (1977) Tomato spotted wilt *Department of Agriculture Biology Branch Bulletin PD 166C* (2nd edition)
- Anon. (1977) Clover rust *Department of Agriculture Biology Branch Bulletin PD 167C* (2nd edition)
- Ballantyne, Barbara (1976) Diseases of beans *Department of Agriculture Biology Branch Bulletin PD 85* (7th edition)
- Ballantyne, Barbara (1976) Bulletin of bean disease research programme No. 2 *Department of Agriculture Biology Branch*
- Ballantyne, Barbara (1976) Diseases of dry beans *Department of Agriculture Biology Branch Bulletin PD 199* (2nd edition)
- Kable, P. F. and Hutton, R. J. (1976) Post harvest evaluation of new chemical treatments for the control of brown rot and soft rots (caused by *Rhizopus* sp.) *Department of Agriculture Research for the Fruit Industries, Stone and Berry Fruits* 1976 p. 38
- Nair, N. G. (1977) Grow your own mushrooms *Department of Agriculture Biology Branch Bulletin S18* (2nd edition)
- Contributions to Journals**
- Baker, J. D. and Letham, D. B. (1977) Field fumigation for vegetables *Agricultural Gazette of N.S.W.* **88** (2): 36
- Bertus, A. L. (1976) A fungal leaf spot and stem blight of Australian native plants *Agricultural Gazette of N.S.W.* **87** (5): 22
- Bertus, A. L. and Wood, J. E. (1977) The effects of soil applications of three fungicides on root rot caused by *Phytophthora cinnamomi* Rands *Phytopathologische Zeitschrift* **88**: 229
- Broadbent, P. and Fraser, L. R. (1977) Sudden death—a disease of citrus *Agricultural Gazette of N.S.W.* **88** (1): 30
- Conroy, R. J. and Letham, D. B. (1977) Cabbage (*Brassica oleracea* var *capitata* "No. 240") Club Root—*Plasmodiophora brassicae* *Fungicide and Nematicide Tests, Volume 32 Results of 1976* Published by the American Phytopathological Society p. 77
- Cother, E. J., Darbyshire, B. (CSIRO) and Brewer, J. (CSIRO) (1976) *Pseudomonas aeruginosa*: cause of internal brown rot of onions *Phytopathology* **66**: 828
- Dephoff, C. and Nuzum, C. E. (1976) A new bacterial spot on a magnolia hybrid *Australian Plant Pathology Society Newsletter* **5** (3): 32
- Koffman, K. and Penrose, L. J. (1976) *Sclerotinia fructicola* tolerant to benomyl detected in New South Wales *Australian Plant Pathology Society Newsletter* **5** (3): 34
- Kuiper, J. (1976) Eyespot lodging of wheat and barley *Agricultural Gazette of N.S.W.* **87** (6): 6
- Kuiper, J. with Banyer, R. J. (Riverina College of Advanced Education) (1976) Aerial survey of eyespot lodging of wheat in southern New South Wales *Australian Plant Pathology Society Newsletter* **5** (4): 47

- Letham, D. B. (1977) Potato (*Solanum tuberosum* "Sebago") Rhizoctonia disease—*Rhizoctonia solani* Fungicide and Nematicide Tests Volume 32, Results of 1976 Published by the American Phytopathological Society p. 95
- McGechan, J. K. (1977) Black spot of strawberry *Agricultural Gazette of N.S.W.* **88** (3): 26
- McGechan, J. K. and Fahy, P. C. (1976) Angular leaf spot of strawberry *Xanthomonas fragariae*: first record of its occurrence in Australia, and attempts to eradicate the disease *Australian Plant Pathology Society Newsletter* **5** (4): 57
- McLeod, R. W. (1977) Control of root knot in tomatoes: trials with granular insecticides *Agricultural Gazette of N.S.W.* **88** (3): 38
- McLeod, R. W. with Mathur, V. K. (Indian Agricultural Research Institute, New Delhi) (1977) Plant parasitic nematodes in rice soils in New South Wales *Search* **8**: 130
- Nair, N. G. (1976) Studies on recycling spent compost for mushroom cultivation *Australian Journal of Agricultural Research* **27**: 857
- Nair, N. G. and Baker, H. J. (1977) Benzimidazole fungicides control wet bubble disease in mushrooms *Agricultural Gazette of N.S.W.* **88** (3): 24
- Nair, N. G. and Hayes, W. A. (University of Aston, Birmingham) (1976) Effects of volatile metabolic by products of mushroom mycelium on the ecology of the casing layer *Mushroom Science* **9**: 259
- Nuzum, C. E. (1976) Control of *Claviceps phalaridis* Walker with urea *Australian Plant Pathology Society Newsletter* **5** (2): 23
- Pares, R. D. (1976) Plant diseases identified with the electron microscope *Agricultural Gazette of N.S.W.* **87** (6): 2
- Penrose, L. J. and Koffman, W. (1977) Tolerance of *Sclerotinia fruticola* to benzimidazole fungicides and control of the fungus *Phytopathologische Zeitschrift* **88** (2): 153
- Penrose, L. J., Tarran, J. (University of New South Wales) and Wong, A. L. (University of New South Wales) (1976) First record of *Sclerotinia laxa* Aderh. and Ruhl. in New South Wales. Differentiation from *S. fruticola* (Wint.) Rehm by cultural characteristics and electrophoresis *Australian Journal of Agricultural Research* **27**: 547
- Philpotts, H. R. (1976) Filter mud as a carrier for *Rhizobium* inoculants *Journal of Applied Bacteriology* **41**: 277
- Philpotts, H. R. (1977) Effect of inoculation method on rhizobium survival and plant nodulation under adverse conditions *Australian Journal of Experimental Agriculture and Animal Husbandry* **17**: 308
- Roughley, R. J., Blowes, W. M. and Herridge, D. F. (1976) Nodulation of *Trifolium subterraneum* by introduced rhizobia in competition with naturalized strains *Soil Biology and Biochemistry* **8** (5): 403
- Sherf, A. F. (Cornell University, U.S.A.) The role of extension specialists in agricultural production *Australian Plant Pathology Society Newsletter* **5** (3): 43
- Smith, A. M. with Cook, R. J. (Washington State University) (1977) Influence of water potential on production of ethylene in soils *Canadian Journal of Microbiology* **23**: 811
- Walker, J. (1976) Rusts on *Oxalis* and *Mahonia* in Australia *Australian Plant Pathology Society Newsletter* **5** (4): 60
- Walker, J. with Edwards, D. E. (Forestry Commission of New South Wales) (1976) *Dothistroma septospora* on *Pinus* in Australia *Australian Plant Pathology Society Newsletter* **5** (2): 25
- Walker, J. and Evans, G. (1976) Ergot of cereals in Australia *Australian Plant Pathology Society Newsletter* **5** (4): 54
- Walker, J. with Langdon, R. F. N. (University of Queensland) and Kollmorgen, J. F. (Department of Agriculture, Victoria) (1976) The nomenclature of the smuts of wheat, barley, oats, rye and certain grasses *Australian Plant Pathology Society Newsletter* **5** (4): 52
- Worrall, V. S. and Roughley, R. J. (1976) The effect of moisture stress on infection of *Trifolium subterraneum* L. by *Rhizobium trifolii* Dang. *Journal of Experimental Botany* **27**: 391
- Wong, P. T. W. (1977) Yellow leaf spot disease of wheat *Agricultural Gazette of N.S.W.* **88** (3): 10
- Contributions to Technical Conferences**
- Baker, K. F. (University of Oregon) (1977) Seed transmission of plant pathogens *Australian Seeds Research Conference* Tamworth **3** (C): 29
- Ballantyne, Barbara and McIntosh, R. A. (University of Sydney) (1977) The genetic basis of rust resistance in bean *Proceedings of 3rd International Conference of SABRAO in Association with Australian Plant Breeders Conference* Canberra February 1977 **4** (a): 13
- Broadbent, P. (1976) The role of microorganisms in determining plant growth *Proceedings 1st Horticultural Refresher Course* Lawes Queensland p. 47
- Broadbent, P. (1977) Phytophthora disease of citrus—a review *International Society of Citriculture Meeting*, Orlando Florida Abstract E-49: 78
- Broadbent, P., Fraser, L. R., Beattie, A., Grylls, N. (CSIRO) and Duncan, J. (1977) The Australian citrus dieback problem *International Society of Citriculture Meeting* Orlando Florida Abstract C-21: 52
- Cother, E. J. (1976) Situation report on rapeseed blackleg research in New South Wales *Australian Oilseeds and Protein Grains Research Conference* Toowoomba **4** (a): 1
- Cother, E. J. (1976) Seed transmitted diseases of *Cicer arietinum* *Australian Oilseeds and Protein Grains Research Conference* Toowoomba **4** (a): 7
- Evans, G. (1976) The role and responsibility of the plant pathologist in plant quarantine *2nd National Plant Pathology Conference* Brisbane (reprinted in *Australian Plant Pathology Society Newsletter* **5** (2): 17)
- Evans, J. (1976) Nodulation of soybean (cv. Ruse) in the Macquarie Valley—effect of inoculation method and nitrogen fertiliser on nodulation, plant N, grain yield and quality *Australian Oilseeds and Protein Grains Research Conference* Toowoomba **2** (C): 21
- Fitzell, R. D. and Evans, G. (1976) The application of immunofluorescence technique to the study of *Verticillium dahliae* Kleb. in soil *2nd International Verticillium Symposium* University of California p. 17
- Fraser, L. R. (1976) Diseases of citrus trees in Australia—the first hundred years *1st Daniel McAlpine Memorial Lecture 2nd National Plant Pathology Conference, Brisbane* (reprinted in part in *Australian Plant Pathology Society Newsletter* **5**: 3: 37)

- Letham, D. B. and Bertus, A. L. (1977) Treatment for the control of seed borne pathogens *Australian Seeds Research Conference*, Tamworth 3 (C): 37
- Long, K., Fraser, L. R., Bacon, P. and Broadbent, P. (1977) The Benton Citrange—a promising Phytophthora resistant stock for fruit trees *International Society of Citriculture Meeting Orlando*, Florida Abstract D-10: 16
- Long, K., Fraser, L. R., Broadbent, P. and Duncan, J. (1977) Dwarfing of citrus trees by inoculation with a pathogen *International Society of Citriculture Meeting Orlando*, Florida Abstract C-13: 30
- McLeod, R. W. and Khair, G. T. (Australian Department of Health) (1976) Control of *Aphelenchoides composticola* with nematicides *Proceedings of the 6th Mushroom Industry Short Course Parramatta* p. 134
- Nair, N. G. (1976) Casing materials *Proceedings of the 6th Mushroom Industry Short Course Parramatta* p. 114
- Nair, N. G. (1976) Pathogenic disorders and associated problems of the mushroom crop in 1975-76 *Proceedings of the 6th Mushroom Industry Short Course Parramatta* p. 121
- Nair, N. G. (1976) Cultivation of (*Agaricus bisporus*) Lange Sing in Australia *First Symposium on Survey and Cultivation of Edible Mushrooms in India* Srinagar p. 19
- Smith, A. N. (1976) Anaerobic microsites in the rhizosphere of plants as mechanisms for increasing phosphate availability *Reviews in Rural Science* 3, *Symposium on Prospects for Improving the Efficiency of Phosphate Utilization* University of New England p. 17

Post Graduate Theses

- Pares, R. D. (1976) *The host-pathogen relationships of Pseudoperonospora humuli on leaves of hops cv. Eastwell Golding* D.I.C. thesis Imperial College of Science and Technology, London

Book Chapters

- Roughley, R. J. with Date, R. A. (CSIRO) (1977) Preparation of legume seed inoculants: chapter 7 in *A treatise on Dinitrogen Fixation Section IV Agronomy and Ecology* edited by R. W. F. Hardy and A. H. Gibson (John Wiley & Sons, Sydney)
- Walker, J. (1976) An introduction to seed pathology *Australian Seed Testing Proficiency Course Notes L2*

Other Publications

- Broadbent, P. and Trouchoulis, T. (1976) Soil management to prevent avocado root rot *Australian Horticultural Research Newsletter* 41: 69
- Broadbent, P. and Fraser, L. R. (1976) Citrus dieback affecting an increasing number of trees *Australian Citrus News* 50: 7
- Broadbent, P., Fraser, L. R., Wellings, C., Pares, R. D., Beattie, G. A. C. and Grylls, N. (CSIRO) (1976) Citrus dieback *Australian Horticultural Research Newsletter* 43: 20
- Evans, G. (1976) Central Cotton Research Institute, Multan, Pakistan; cotton disease research *Consultant Report AG:DP/PAK/73/026 The Food and Agriculture Organization of the United Nations Rome*
- Johnson, J., Penrose, L. J. and Thwaite, W. G. (1976) Deciduous fruits spray calendar Tablelands, Slopes and Coastal Highlands of N.S.W. Vol. 16: 1976-77 (J. T. O'Mara & Sons, Sydney)
- McLeod, R. W. (1976) How root knot nematodes are identified *Australian Tobacco Growers Bulletin* 23: 21
- McLeod, R. W. (1976) How non-fumigant nematicides control nematodes *Australian Tobacco Growers Bulletin* 23: 51
- McLeod, R. W. and Mead, J. A. (1977) Non-fumigant nematicides for control of root knot nematodes in northern New South Wales *Australian Tobacco Growers Bulletin* 24: 21
- Martin, R. H., Kuiper, J., Murray, G. M. and May, C. E. (1976) Septoria leaf blotch, a major disease of wheat *Bulk Wheat* 10: 49
- Medd, R. W. and Murray, G. M. (1976) Detection of a possible seed borne disease in introduced *Bromus* spp. *Australian Seed Science Newsletter* 2: 67
- Nair, N. G. (1976) Results from studies of using spent compost and New South Wales peat as a casing material *Journal of the Australian Mushroom Growers Association* 2 (5): 24
- Nair, N. G. (1976) Method of diagnosis of virus diseases *Journal of the Australian Mushroom Grower's Association* 2 (5): 22
- Nair, N. G. (1976) Commercial application of biological control of mushroom brown blotch *Journal of the Australian Mushroom Growers Association* 2 (5): 14
- Nair, N. G. (1976) Research report on biological control of blotch, use of casing material and use of fungicides on *Mycogone* *Journal of the Australian Mushroom Growers Association* 2 (6): 15
- Walker, J. (1976) Issue of duplicate specimens from Herb. DAR *Roneoed List of 133 Specimens Issued to Local and Overseas Herbaria as Part of Exchange Agreements with Them*

CHEMISTRY BRANCH

Department of Agriculture Bulletins and Booklets

- Jacob, E. H., Bird, E. T., Blakeney, A. B. and Almgren, G. (1977) A basis for the identification of Durum wheat at silo receival centres *N.S.W. Department of Agriculture Cereal Quality Research Report* 77/01
- Solvyns, A. (1976) Survey of chemical analyses of feedstuffs 1973-1974 *N.S.W. Department of Agriculture, Poultry Research Station, Seven Hills, Occasional Technical Notes* 1/76
- Vimpany, I., Wright, W. A. and Bradley, J. (1976) *N.S.W. Department of Agriculture Biological and Chemical Research Institute Bulletin* S91

Contributions to Journals

- Batten, G. D. (1976) The cycling of phosphorus: faecal P *Agrochimica* 20 (b)
- Batten, G. D. (1977) Some good reasons for checking soil phosphate level *Agricultural Gazette of N.S.W.* 88 (1): 7
- Blakeney, A. B. (1976) Morphology of rice grain breakage *International Union of Food Science and Technology R.I.C.E. Report* 1976 p. 6

- Blakeney, A. B. and Chesterfield, R. S. (1976) Effect of moisture on kernel hardness and milling quality of rice *International Union of Food Science and Technology R.I.C.E. Report* 1976 p. 3
- Gilbert, W. S., Singh, G. and Macindoe, R. N. (1976) DDT residues in poultry from rice hulls used as poultry litter *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 704
- Holford, I. C. R. and Gleeson, A. C. (1976) Residual effect of phosphorus on white clover on granitic soils *Australian Journal of Agricultural Research* **27**: 509
- Holford, I. C. R. (1976) Effects of phosphate buffer capacity of soil on the phosphate requirements of plants *Plant and Soil* **45**: 433
- Holford, I. C. R. (1976) Phosphate and sulphur for pastures on Bendemeer granitic soils *Agricultural Gazette of N.S.W.* **87** (5): 42
- Holford, I. C. R. (1977) Soil properties related to phosphate buffering in calcareous soils *Communications in Soil Science and Plant Analysis* **8**: 125
- Leece, D. R. (1976) Diagnostic leaf analysis for stone fruit 7. Effects of fertilizer nitrogen, phosphorus and potassium on leaf composition of peach *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 775
- Leece, D. R. (1976) Diagnosis of nutritional disorders of fruit trees by leaf and soil analyses and biochemical indices *Journal of the Australian Institute of Agricultural Science* **42**: 3
- Leece, D. R. (1976) Composition and ultrastructure of leaf cuticles from fruit trees, relative to differential foliar absorption *Australian Journal of Plant Physiology* **3**: 833
- Leece, D. R. and Dirou, J. F. (1977) Organosilicone and alginate adjuvants evaluated in urea sprays foliar-applied to prune trees *Communications in Soil Science and Plant Analysis* **8**: 169
- McCleary, B. V., Matheson, N. K. and Small, D. M. (1976) Galactomannans and a galactoglucomannan in legume seed endosperms: structural requirements for B-mannanase hydrolysis *Phytochemistry* **15**: 1111
- McCleary, B. V. and Chick, B. F. (1977) The purification and properties of a thiaminase I enzyme from nardoo (*Marsilea drummondii*) *Phytochemistry* **16**: 207
- Milham, P. J. and Short, C. C. (1976) Variation in ambient temperature as a source of error in absorbance measurements made with single-beam spectrophotometers *Analyst* **101**: 579
- Milham, P. J. and Thomson, P. (Australian Museum) (1976) Relative antiquity of human occupation and extinct fauna at Madura cave, southeastern Western Australia *Mankind* **10**: 175
- Osborne, G. J. (1976) The extraction and definition of non-exchangeable or fixed ammonium in some soils from southern New South Wales *Australian Journal of Soil Research* **14**: 373
- Osborne, G. J. (1976) The significance of intercalary ammonium in representative surface and subsoils from southern New South Wales *Australian Journal of Soil Research* **14**: 381
- Osborne, G. J. and Storrier, R. R. (1976) The influence of different sources of nitrogen fertilizer on the value of soil nitrogen tests *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 881
- Osborne, G. J. and Storrier, R. R. (1976) Efficiency of utilization of nitrogen fertilizers on representative soils from southern New South Wales *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 875
- Pym, R. V. E. and Milham, P. J. (1976) Selectivity of reaction among chlorine, ammonia and salicylate for determination of ammonia *Analytical Chemistry* **48**: 1413
- Saini, H. S. and Matheson, N. K. (University of Sydney) (1977) Oligosaccharide and polysaccharide changes in germinating lupin cotyledons *Phytochemistry* **16**: 59
- Saini, H. S. and Matheson, N. K. (University of Sydney) (1977) d-l-arabinofuranisodases and B-D-galactosidases in germinating lupin cotyledons *Carbohydrate Research* **57**: 222
- Singh, G., Rippon, L. E., Gilbert, W. S. and Wild, B. L. (1976) Inorganic bromide residue in bananas, bell capsicums (sweet peppers), cherries and apples following fumigation with ethylene dibromide and methyl bromide *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 780
- Singh, G., Rippon, L. E. and Gilbert, W. S. (1977) 2,4-D residues in stored lemons from postharvest treatments *Australian Journal of Experimental Agriculture and Animal Husbandry* **17**: 167
- Weir, R. G., Nagle, R. K., Noonan, J. B. and Towner, A. G. W. (1976) The effect of foliar and soil applied molybdenum treatments on the molybdenum concentration of maize grain *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 761

Contributions to Technical Conferences

- Abbott, T. S. (1975) Structural stability to wetting of some irrigation soils of N.S.W. Working papers N.S.W. Branch Conference, Australian Society of Soil Science Incorporated Tamworth
- Bacon, P. E. (1977) Fertilizers and soil nutrients under trickle irrigation Working papers Trickle Irrigation Workshop Gosford
- Bacon, P. E. and Polkinghorne, R. V. E. (1977) Effects of gypsum on unstable soils in rice bays Working papers A.C.T. Branch Conference, Australian Society of Soil Science Incorporated Canberra
- Barnes, W. C. and Blakeney, A. B. (1976) Resolving flour maltose value into its starch damage and alpha amylase components *Combined Convention of the Australian and New Zealand Institutes of Food Science and Technology Rotorua Abstracts* p. 37
- Blakeney, A. B., Almgren, G., Finlayson, W. and Jacob, E. H. (1975) High speed camera analysis of the first break in flour milling *Proceedings of the 25th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Newport p. 31
- Blakeney, A. B. (1976) Waxy rice and other waxy cereal starches *Proceedings of the 26th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Broadbeach p. 63
- Blakeney, A. B. and Welsh, L. A. (1976) Starch granule size distributors of some Australian wheats *Proceedings of the 26th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Broadbeach p. 66
- Blakeney, A. B. and Barnes, W. C. (1976) The Parbah resolved maltose method *Proceedings of the 26th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Broadbeach p. 70

- Blakeney, A. B. (1976) Scanning electron microscope study of suncracking in rice *Proceedings of the 26th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Broadbeach p. 72
- Blakeney, A. B. (1976) Factors affecting the hardness of rice grains Working papers *Riverina Branch Conference, Australian Society of Soil Science Incorporated* Deniliquin
- Bird, E. T. (1976) To an understanding of seed dormancy Working papers *National Parks and Wildlife Conference* Tamworth
- Bird, E. T., Easter, J. D. and Arnold, J. (University of New England) (1976) Effects of cereal rusts on the milling and baking quality of selected wheat cultivars in north-western New South Wales *Proceedings of the 26th Annual Conference of the Royal Australian Chemical Institute, Cereal Chemistry Division* Broadbeach p. 60
- Bird, E. T. (1976) Seed dormancy—its influence in maintaining the ecological balance of a plant community *Proceedings of the 1st Ecology Conference of the University of New England* Burrendong p. 59
- Bird, E. T. (1977) Grain drying and its effect on grain viability Working papers *Grain Drying Workshop* Tamworth
- Bradley, J. and Vimpany, I. (1975) Changes in Bray No. 1 soil phosphorus test values resulting from annual applications of superphosphate and fluctuating cyclic rainfall Working papers *N.S.W. Brand Conference, Australian Society of Soil Science Incorporated* Tamworth
- Chesterfield, R. S. and Jacob, E. H. (1976) Continuous recording barley pearler for measuring hardness of wheat and rice grain *Combined Convention of the Australian and New Zealand Institutes of Food Science and Technology* Rotorua Abstracts p. 36
- Gibson, T. S. and Leece, D. R. (1977) Enzymatic determination of physiologically active zinc in *Zea mays* L. 18th General Meeting of the Australian Society of Plant Physiologists Brisbane Abstracts p. 83
- Glennie Holmes, M. R. and Davey, K. H. (1976) Utilisation of oilseed meals in bread manufacture *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 1 (c): 6
- Glennie Holmes, M. R. and Spence, T. B. (1976) The effect of sulphur fertilizer on rapeseed *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 2 (b): 28
- Glennie Holmes, M. R., Wratten, N. and Blakeney, A. B. (1976) Paper chromatographic detection of erucic acid after enzymic hydrolysis *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (a): 31
- Glennie Holmes, M. R. (1976) Protein analysis of rapeseed *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 5: 6
- Jacob, E. H., Blakeney, A. B. and Almgren, G. (1975) Rye production, processing and utilisation 9th Convention of the Australian Institute of Food Science and Technology Adelaide Abstracts p. 31
- Lawrie, R. A. (1976) A survey of soil potassium on the south coast and tablelands of N.S.W. Working papers *Riverina Branch Conference, Australian Society of Soil Science Incorporated* Wagga Wagga
- Leece, D. R. and Milham, P. J. (1975) Occurrence of physiologically-inactive zinc in *Zea mays* relative to plant composition 16th General Meeting of the Australian Society of Plant Physiologists Melbourne Abstracts p. 99
- Leece, D. R. (1977) Enhancement of foliar absorption in *Prunus domestica* L. 18th General Meeting of the Australian Society of Plant Physiologists Brisbane Abstracts p. 84
- Major, E. J. and Blakeney, A. B. (1976) The trypsin inhibitor levels and urease activities of some soybean varieties *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 1 (d): 1
- McCleary, B. V. (1977) Enzymatic analysis of the structures of galactomannans 21st Annual Meeting of the Australian Biochemical Society Brisbane Abstracts p. 29
- Osborne, G. J. (1976) The value and measurement of soil structure under systems of reduced and conventional cultivation *International Society of Soil Science—Conference on Soil Structure, Commission 1* Adelaide
- Osborne, G. J. (1977) Some problems of soil acidity in southern N.S.W. Working papers *A.C.T. Branch Conference, Australian Society of Soil Science Incorporated* Canberra
- Pym, R. V., Gilbert, W. S. and Singh, G. (1976) The effect of dichlorvos (DDVP) as a contaminant in the feed, on the performance of laying hens *First Australian Poultry and Stock Feed Convention* Melbourne 2: 313
- Pym, R. V. and Kennedy, I. R. (University of Sydney) (1976) Electrophoretic patterns of storage protein from nodulated and unnodulated soybeans *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 2 (c): 17
- Short, C. C., Milham, P. J. and MacLeod, J. Y. (Private Industry) (1976) Design of auto-programmer for AutoAnalyser System 1 to permit direct digital readout *Proceedings of the 10th Australian Spectroscopy Conference* p. 223

Post Graduate Theses

- Bird, E. T. (1976) *Seed dormancy in selected grasses* Litt.B. thesis University of New England
- Batten, G. D. (1976) *Residual soil phosphate for clover ley farming* M.Rur.Sc. thesis University of New England
- McCleary, B. V. (1976) *The metabolism of galactomannan in germinating legume seeds* Ph.D. thesis University of Sydney
- Saini, H. S. (1977) *Carbohydrate metabolism in cotyledons of germinating lupin (*Lupinus luteus*) seeds* Ph.D. thesis University of Sydney

Other Publications

- Abbott, T. S. (1976) Importance of soil structure in irrigation farming *Irrigation Farmer* 3 (3): 2
- Awad, A. S. and Abbott, T. S. (1976) Effect of water salinity and irrigation management on soil salinity and structure at Lake Tandou, N.S.W. *Australian Salinity Newsletter* 4: 65
- Baker, H. J. and Rippon, L. E. (1977) Behaviour of sec butylamine (2-AB) under simulated citrus packing line conditions *Australian Horticultural Research Newsletter* 44: 50
- Batten, G. D. and Khan, M. A. (1976) The cost of the P drain *Australian Field Crops Newsletter* 11: 15

- Batten, G. D. and Osborne, G. J. (1976) Effects of superphosphate on the growth of oilseed rape on soil with high and low nitrogen status *Australian Field Crops Newsletter* **11**: 54
- Blakeney, A. B. (1977) Suncracking *Annual Report of the Chairman of the Rice Marketing Board of N.S.W.* p. 28
- Gilbert, W. S. and Singh, G. (1975) Pesticide investigations in the Namoi cotton area *Cotton Newsletter* **10**: 3
- Lewis, C. E. and Croft, M. G. (1976) Modifications to the Hanus iodine absorption number method *Journal of the Association of Official Analytical Chemists* **59** (5): 1188

ENTOMOLOGY BRANCH

Department of Agriculture Bulletins and Booklets

- Anon. (1976) Apple leaf-hopper *Insect Pest Bulletin* **43**
- Anon. (1976) Case moths *Insect Pest Bulletin* **105**
- Anon. (1976) Detection and control of termites *Insect Pest Bulletin* **17**
- Anon. (1976) Earth mites *Insect Pest Bulletin* **77**
- Anon. (1976) Heliothis caterpillars *Insect Pest Bulletin* **26**
- Anon. (1976) Soldier beetles *Insect Pest Bulletin* **115**
- Anon. (1977) Black peach aphid *Insect Pest Bulletin* **19**
- Anon. (1977) Pear and cherry slug *Insect Pest Bulletin* **124**
- Anon. (1977) The Argentine ant *Insect Pest Bulletin* **111**
- Anon. (1977) Spotted alfalfa aphid *Insect Pest Bulletin*
- Casimir, M. (1976) The aerial spraying of locusts in New South Wales from 1955 to 1970 *Science Bulletin* **86** *Department of Agriculture New South Wales*
- Gellatley, J. G. (1976) Spined citrus bug *Insect Pest Bulletin* **145**
- Gellatley, J. G. and Jones, E. L. (1977) Tree hoppers—citrus and stone fruit pests *Insect Pest Bulletin* **122**
- Goodyer, G. J. (1976) Snails and slugs *Insect Pest Bulletin* **1**
- Goodyer, G. J. (1977) White fringed weevil *Insect Pest Bulletin* **130**
- Hamilton, J. T. (1976) Springtails *Insect Pest Bulletin* **54**
- Hamilton, J. T. (1976) Tomato mite *Insect Pest Bulletin* **56**
- Hamilton, J. T. (1976) Seedling maggots *Insect Pest Bulletin* **104**
- Schicha, E. (1976) Mites in buildings *Insect Pest Bulletin* **89**
- Thompson, J. I. (1976) Cineraria leaf miner *Insect Pest Bulletin* **87**
- Thompson, J. I. (1976) Leaf-cutting bees *Insect Pest Bulletin* **118**
- Wright, W. E. (1976) Banana weevil borer *Insect Pest Bulletin* **34**

Contributions to Journals

- Attia, F. I. (1976) Insecticide resistance in moth pests of grain *Agricultural Gazette of N.S.W.* **87** (6): 45
- Attia, F. I. (1976) Insecticide resistance in *Cadra cautella* in New South Wales, Australia *Journal of Economic Entomology* **69**: 773
- Baker, G. L. (1976) Migratory locust moves south *Agricultural Gazette of N.S.W.* **87** (3): 61
- Bower, C. C. (1977) Inhibition of larval growth in the Queensland fruit fly, *Dacus tryoni* (Diptera: Tephritidae) in apples *Annals of the Entomological Society of America* **70** (1): 97
- Greening, H. G., Finlayson, W. H., Fishpool, K. I., Garland, P. J. (1976) Cold comfort for grain pests *Agricultural Gazette of N.S.W.* **87** (2): 61
- Hamilton, J. T. and Attia, F. I. (1977) Effects of mixtures of *Bacillus thuringiensis* and pesticides on *Plutella xylostella* and the parasite *Thyraeella collaris* *Journal of Economic Entomology* **70** 146
- Rand, J. R. and Wright, W. E. (1976) Armyworm outbreaks in pastures *Agricultural Gazette of N.S.W.* **87** (5): 15
- Schicha, E. (1976) The undescribed male of *Amblyseius bellinus* (Womersley), and females of the latter and *A. cucumeria* (Oudemans) redescribed (Acari: Phytoseiidae) *Zeitschrift fur angewandte Zoologie* **63**: 333
- Schicha, E. (1977) Immature stages of three mite species (Acari: Phytoseiidae) from apple in Australia *Proceedings of the Linnean Society of N.S.W.* **101**: 149
- Shanahan, G. J. and Roxburgh, N. A. (1976) OP's still prevent body strike in young sheep *Agricultural Gazette of N.S.W.* **87** (4): 42
- Thwaite, W. G. (1976) Oil for San Jose scale *Agricultural Gazette of N.S.W.* **88** (3): 47
- Wallbank, B. E. and Greening, H. G. (1976) Insecticide resistance in grain insects *Agricultural Gazette of N.S.W.* **87** (4): 29
- Wright, W. E. (1976) Insecticides for the control of dieldrin-resistant banana weevil borer *Cosmopolites sordidus* Germar *Australian Journal of Experimental Agriculture and Animal Husbandry* **17**: 499

Contributions to Technical Conferences

- Forrester, N. W. (1976) Preliminary ecological studies on *Nysius vinitor* Bergroth and *Nysius clevelandensis* Evans *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (b)-3
- Goodyer, G. J. (1976) Laboratory culturing and bioassay of the green vegetable bug, *Nezara viridula* *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (b)-9
- Greenup, L. R. and Forrester, N. W. (1976) Insect complex on sunflowers in north western New South Wales *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (b)-2
- Thwaite, W. G. (1976) Insecticidal control of aphids in rapeseed and effects on honey bees *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (b)-5

Other Publications

- Beattie, A. (1976) Citrus red mite research *Rural Newsletter* **59**: 36
- Clift, A. D. (1976) Report on trial to evaluate casing layer drenching against sciarid pests of mushrooms *Australian Mushroom Growers Journal* **2** (6): 21
- Clift, A. D. (1976) Report on cooperative trial against sciarid pests of mushrooms *Australian Mushroom Growers Journal* **2** (6): 24
- Clift, A. D. (1977) Recent developments in the mushroom insect and mite pest situation *Australian Mushroom Growers Association Newsletter* June 1977
- Gellatley, J. G. (1976) Controlling black thrips blemish on Valencias *Rural Newsletter* **59**: 13
- Gellatley, J. G. (1977) Sulphur as an insecticide *Rural Newsletter* **62**: 33
- Gellatley, J. G. (1977) Black thrips blemish on Valencias *Rural Newsletter* **62**: 28
- Goodwin, S. (1977) Mites: the major pest problem of strawberries *Rural Newsletter* **60**: 10
- Greening, H. G. (1976) Report on an overseas study tour of U.S.A., Canada, England, West Germany and Denmark concerning stored product insects, September 28 to November 30, 1974
- Greenup, L. R. (1977) What are pyrethroids? *Cotton Newsletter* **25**: 5
- Hamilton, J. T. (1976) Chlordimeform for the control of vegetable pests *Vegetable Research Newsletter* **33**: 17
- Tuart, L. D. (1976) Aerial insecticide trial for *Heliothis armigera* control *Cotton Newsletter* **23**: 2
- Shanahan, G. J. (1976) Report following official visit to U.S.A. to attend XV International Congress of Entomology, Washington D.C., 19-27th August, 1976

DIVISION OF DAIRYING

Department of Agriculture Bulletins and Booklets

- Fell, L. R. (1977) Milking machine component testing *Milking Systems* **3** (1): MMT120
- Phillips, K. R. (1976) S.E.P.—A short story *Extension Forum* **11**: 12
- Ubrihien, C. (1976) Common defects in milk and cream *N.S.W. Department of Agriculture Dairying Bulletin* **D14**

Contributions to Journals

- Armfield, L. (1976) Getting value from detergents *Dairy Topics* **13**: 27
- Ashwood, A. and Stevens, G. (1977) Artificial breeding or natural service—which is the most profitable *Dairy Topics* **14**: 7
- Barkley, M. B. and Desjardins, P. R. (1977) Simple, effective method for purifying the AS-1 cyanophage *Journal of Applied and Environmental Microbiology* **33**: 971
- Barnes, R. N. and Hripko, N. S. (1977) Apparatus for automating a bactericidal capacity test *Australian Journal of Dairy Technology* **32** (1): 31
- Battese, D. F. (1977) Did you forget your holiday food supply? *Dairy Topics* **14**: 30
- Buesnell, D. (1976) Feed fermented colostrum cut costs *Dairy Topics* **12**: 14
- Calder, B. O. E. (1976) Keeping milk pure *Dairy Topics* **12**: 11
- Calder, B. O. E. (1977) Your cows know all about pulsation—do you? *Dairy Topics* **14**: 16
- Curtin, W. T. (1977) Relief from wind and sun *Dairy Topics* **14**: 12
- Curtin, W. T. (1977) Nostalgia *Dairy Topics* **14**: 33
- Davis, J. (1977) New methods of payment for milk *Dairy Topics* **13**: 23
- Dunsmore, D. G. (1976) Iodophors and iodine in dairy products 1. The iodine content of Australian dairy products *Australian Journal of Dairy Technology* **31** (4): 125
- Dunsmore, D. G. and Nuzum, Co. (1977) Iodophors and iodine in dairy products 2. Udder washes and salves *Australian Journal of Dairy Technology* **32** (1): 42
- Dunsmore, D. G., Nuzum, Co. and Dettman, Belinda (1977) Iodophors and iodine in dairy products 3. Teat dipping *Australian Journal of Dairy Technology* **32** (1): 45
- Fell, L. R. with Fulkerson, R. D., McDowell, G. H. (University of Sydney) and Hooley, R. D. (University of Melbourne) (1976) Artificial induction of lactation in ewes: the involvement of progesterone and prolactin in lactogenesis *Australian Journal of Biological Science* **29**: 357
- Fell, L. R. (1977) Milking machine testing *Dairy Topics* **13**: 11
- Freckelton, D. A. (1976) What's wrong with herringbones? *Dairy Topics* **11**: 10
- Freckelton, D. A. and Walker, R. (1976) How much super? *Dairy Topics* **12**: 21
- Goulding, P. F. and Benson, R. J. (1977) More milk but not more money *Dairy Topics* **13**: 16
- Hart, C. K. (1977) The case of the corrupt cows *Dairy Topics* **14**: 14
- Heptonstall, D. B. (1976) Artificial breeding in N.S.W. *Dairy Topics* **12**: 15
- Heptonstall, D. B. (1976) Jerseys and Guernseys wanted for S.E.P. *Dairy Topics* **12**: 23
- Heptonstall, D. B. (1977) Export potential for Australian dairy cattle *Dairy Topics* **14**: 26
- Ibrahim, G. F. (1976) Detection and enumeration of coagulase positive staphylococci in dairy products 2. Recovery of sub-lethally heat stressed cells *Australian Journal of Dairy Technology* **31**: 138
- Ibrahim, G. F. (1977) Detection and enumeration of coagulase positive staphylococci in dairy products 3. Evaluation of the performance of the strip method *Australian Journal of Dairy Technology* **32**: 35
- Kratz, J. D. (1977) Fodder cane emergency or production ration *Dairy Topics* **14**: 2
- Logue, I. (1977) Mobile feed troughs *Dairy Topics* **13**: 29
- Macindoe, A. W. (1977) Checking your cows milk output *Dairy Topics* **13**: 10
- Macindoe, A. W. (1977) A mating recorder *Dairy Topics* **13**: 15
- Morgan, R. M. (1976) What to feed your cows *Dairy Topics* **11**: 15
- Mullins, B. (1976) Industries Assistance Commission on the Dairy Industry *Dairy Topics* **11**: 27
- Noble, W. S. (1977) The feeding management situation *Dairy Topics* **14**: 4

- O'Loughlin, P. J. (1977) Safe drum storage of fuel on the farm *Dairy Topics* **14**: 32
- Phillips, K. (1976) What's new in S.E.P. and contract mating *Dairy Topics* **11**: 12
- Phillips, K. (1976) Bulls just how good *Dairy Topics* **12**: 19
- Potts, A. K. (1977) When you convert make sure it's right *Dairy Topics* **14**: 22
- Rathore, A. K. (1976) Relationships between teat shape, production and mastitis in Friesian cows *British Veterinary Journal* **132** (4): 389
- Rathore, A. K. and Sheldrake, R. F. (1977) Teat orifice stretchability associated with teat diameter gradient and milk yield in lactating cows *Animal Production (U.K.)* **24** (2): 215
- Rathore, A. K. (1977) Teat diameter gradient associated with milk yield and somatic cell count in Friesian cows *Animal Production (U.K.)* **24**: 401
- Rathore, A. K. (1977) Teat shape and production associated with opening and prolapse of teat orifice in Friesian cows *British Veterinary Journal* **133**: 258
- Salkeld, J. N. and Moss, R. V. (1976) The "Salmo" system for feeding molasses *Dairy Topics* **12**: 4
- Smith, R. A. (1976) Labour costing too much? Consider the alternatives *Dairy Topics* **11**: 22
- Stewart, B. A. (1976) More efficient cooling of milk *Dairy Topics* **11**: 7
- Stewart, B. A. (1976) Automatic door openers *Dairy Topics* **12**: 25
- Thomas, M. A. and Manrique, J. (1976) The effect of lupin protein isolation procedures on the emulsifying and water binding capacity of a meat protein system *Journal of Food Technology* **11**: 409
- Thomas, M. A., Turner, A. D., Abad, G. and Towner, Jacinta M. (1977) The influence of types of skim milk powder used and storage conditions in browning reaction on processed cheese spread *Milchwissenschaft* **31** (1): 12
- Thompson, R. J. and Nott, M. J. (1977) Irrigated grain sorghum for dairymen *Dairy Topics* **13**: 17
- Ware, B. H. (1976) The "Cattle Man" project *Dairy Topics* **11**: 19
- Ware, B. H. and Critchley, D. (1977) Mastitis control: the top 15 and how they do it *Dairy Topics* **13**: 2
- Contributions to Technical Conferences**
- Phillips, K. R., Keogh, J. B. and Chambers, S. (1977) Genetic progress in milk and butterfat yield in the artificially bred and herd recorded dairy cattle populations in N.S.W. *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania* Canberra Australia Animal Breeding Papers **4-9**
- Rathore, A. K. (1976) Labour utilisation on dairy farms and problems associated with it *18th International C.I.O.S.T.A. Congress Godollo, Hungary* **18**: 1
- Post-Graduate Thesis**
- Barkley, M. B. (1976) *Ultra-structure of the blue-green alga Anacystis nidulans infected with A5-1 virus* Ph.D. thesis University of California, Riverside
- Other Publications**
- Wheel r, A. M. (1976) Iodine levels in calves *Cumberland Dairy Talk* **4**

EXTENSION SERVICES

Department of Agriculture Bulletins and Booklets

- Barden, D. H. (1976) The role of special extension officers *Report to Extension Officers* **15**
- Barden, D. H. and Lenne, B. D. (1977) Strengths and weaknesses of non veterinary diagnostic services used by extension officers *Report to Extension Officers* **18**
- Barden, D. H. and Potter, J. N. (1977) Review of agricultural extension *Report to Extension Officers* **17**
- Bisset, I. J. W. and Kennedy, D. (1977) 1080 or not 1080—an exercise in formulating policy *Agricultural Gazette of N.S.W.* **88** (1): 13
- Fardy, D. T. and Potter, J. N. (1976) Survey of opinions of objectives and systems of promotion Report to research officers *Report to Extension Officers* **11**
- McEntyre, C. J. (1976) Adoption of results of wheat nutrition research in the Central West *Report to Extension Officers* **14**
- Mitchell, G. R. and Benson, R. J. (1976) Financial study of a sample of North Coast beef properties. *Report to Extension Officers* **13**
- Mitchell, G. R. and Potter, J. N. (1976) Extension in three North Coast shires. *Report to Extension Officers* **12**
- Tindale, E. (1977) The farm crisis and extension *Report to Extension Officers* **16**

Contributions to Journals

- Barden, D. H. (1976) Who knows? *Melbourne Notes on Agricultural Extension* **13**: 109

Contributions to Technical Conferences

- Fardy, D. T. (1976) Educational and vocational counselling for rural farm youth *Contributed Papers for the Workshop on Rural Adjustment Counselling U.N.E., Armidale*, **8.7**

DIVISION OF HORTICULTURE

Department of Agriculture Bulletins and Booklets

- Baker, J. D. and Benson, R. J. (1976) Growing zucchinis (Revised August, 1976) *Farm Management Notes No. 10 North Coast Region*
- Baker, J. D. and Benson, R. J. (1977) Growing sweet potatoes *Farm Management Notes No. 19 North Coast Region*
- Baker, J. D. and Benson, R. J. (1977) Growing golden coomeras *Farm Management Notes No. 20 North Coast Region*
- Beckingham, C. R. (1977) Practical herbicide management in vineyards *Division of Horticulture Bulletin* **H7.3.6**
- Dirou, J. (1977) Fruitgrowing in the Young district *Division of Horticulture Bulletin* **H1.1.10**
- G 38793K—15

- Forsyth, J. B., Weale, C. C. and Logan, R. A. (1976) Strawberry production 10,000 plants: trickle irrigation Windsor district *Mid Coast and Hunter Regional Bulletin M/LCD: 6*
- Kaye, G. R. and Logan, R. A. (1976) Wine grape production—46 hectare unirrigated vineyard, Lower Hunter *Mid Coast and Hunter Regional Bulletin M/LCD: 3*
- Kaye, G. R. and Logan, R. A. (1976) Wine grape production—115 hectare unirrigated vineyard, Lower Hunter *Mid Coast and Hunter Regional Bulletin M/LCD: 4*
- Loebel, M. R. (1977) Citrus growing on the North Coast of N.S.W. *North Coast Regional Bulletin*
- Meakins, L. (1976) Growing green peas *Division of Horticulture Bulletin H8.1.2*
- Meakins, L. (1977) Growing carrots *Division of Horticulture Bulletin H8.1.9*
- Murison, J. A. (1977) Custard apple *Division of Horticulture Bulletin H6.1.3*
- Mutton, L. L. (1977) Rockmelon growing *Division of Horticulture Bulletin H8.1.11*
- Stannard, M. C. and Kaye, G. R. (1976) Vineyard establishment *Division of Horticulture Bulletin H7.2.1*
- Stannard, M. C. (1977) Supplementary irrigation of vineyards *Division of Horticulture Bulletin H7.3.1*
- Sweedman, R. (1977) Almond growing *Division of Horticulture Bulletin H3.1.1*
- Sweedman, R. and Boorman, L. K. (1977) Chestnut growing *Division of Horticulture Bulletin H3.1.13*
- Turkington, C. R. and Freeman, B. M. (1977) Home winemaking *Division of Horticulture Bulletin H7.4.1*

Contributions to Journals

- Baker, J. D. (1976) Vegetable costs of production *Banana Bulletin* 40 (7): 18
- Baker, J. D. (1976) Reducing tomato harvesting costs *Banana Bulletin* 40 (8): 22
- Baker, J. D. (1976) Vegetable seed treatment *Banana Bulletin* 40 (9): 24
- Baker, J. D. (1976) Soil analysis for vegetables *Banana Bulletin* 40 (10): 22
- Baker, J. D. (1976) Windbreaks for vegetables *Banana Bulletin* 40 (11): 22
- Baker, J. D. (1976) Storage requirements for vegetables *Banana Bulletin* 40 (12): 22
- Baker, J. D. (1976) Trellising tomatoes on the North Coast *Agricultural Gazette of N.S.W.* 87 (5): 16
- Baker, J. D. (1976) Hydroponic vegetable growing *Agricultural Gazette of N.S.W.* 87 (6): 32
- Baker, J. D. and Letham, D. B. (1977) Field fumigation for vegetables *Agricultural Gazette of N.S.W.* 88 (2): 36
- Baker, J. D. (1977) Growing barner grass as a windbreak *Agricultural Gazette of N.S.W.* 88 (3): 18
- Baker, J. D. (1977) Mechanising sweet potato production *Agricultural Gazette of N.S.W.* 88 (3): 4
- Baker, J. D. (1977) Forced air cooling *Banana Bulletin* 41 (1): 24
- Baker, J. D. (1977) Cost of farm labour *Banana Bulletin* 41 (2): 24
- Baker, J. D. (1977) Vegetable symposium *Banana Bulletin* 41 (3): 24
- Baker, J. D. (1977) Soil fumigation *Banana Bulletin* 42 (4): 22
- Baker, J. D. (1977) Safe use of chemicals *Banana Bulletin* 42 (6): 14
- Beattie, B. B. and Folley, R. R. W. (Wye College, University of London) (1977) Production variability in apple crops *Scientia Horticulturae* 6: 271
- Beckingham, C. R. (1976) Pneumatic vine pruning *Agricultural Gazette of N.S.W.* 87 (5): 2
- Beckingham, C. R. (1976) Aviation—what can it do for Horticulture? *Agricultural Gazette of N.S.W.* 87 (6): 23
- Bevington, K. B. (1976) Development of union abnormalities in grafts between lemon (*Citrus limon*) and *Poncirus trifoliata* *Australian Journal of Agricultural Research* 27: 661
- Boorman, L. K. and Koffmann, W. (1976) Paspalum control in pome fruit orchards *Agricultural Gazette of N.S.W.* 87 (5): 20
- Cox, J. E. (1976) Effect of time of planting on fruit yield and runner production of cold stored and freshly lifted strawberry plants *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 604
- Dirou, J. F. (1977) Maximum price for top quality prunes *Agricultural Gazette of N.S.W.* 88 (1): 22
- Dirou, J. F. and Leece, D. R. (1977) Organosilicone and alginate adjuvants evaluated in urea sprays foliar applied to prune trees *Soil Science and Plant Analysis* 8 (1): 169
- Forsyth, J. B., Weale, C. C. and Logan, R. A. (1976) Strawberries—are they profitable? *Agricultural Gazette of N.S.W.* 87 (6): 14
- Freeman, B. (1976) Artificial windbreaks in horticulture *Plasticulture* 32: 45
- Freeman, B. and Sarooshi, R. A. (1976) Abscission chemicals for Valencia oranges in New South Wales *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 943.
- Freeman, B. M., Blackwell, J. (CSIRO) and Garzoli, K. (CSIRO) (1976) Irrigation frequency and total water application with trickle and furrow systems *Agricultural Water Management* 1: 21
- Ireland, G. (1977) Avocado symposium *Banana Bulletin* 41 (5): 6
- Koffmann, W. and Kaldor, J. (1976) Post harvest control of brown rot of peaches *Fungicide and Nematicide Tests* 32: 48
- Koffmann, W. and Kaldor, J. (1976) Post harvest control of transit rot of peaches *Fungicide and Nematicide Tests* 32: 49
- Koffman, W. and Kaldor, J. (1976) Post harvest control of brown rot of cherries by Rovral *Fungicide and Nematicide Tests* 32: 39
- Loebel, M. R. (1976) Soil analysis *Banana Bulletin* 40 (9): 12
- Loebel, M. R. (1976) Mechanical harvesting macadamia nuts *Banana Bulletin* 40 (10): 19
- McIntosh, C. B. (1976) Constructing a low cost greenhouse *Agricultural Gazette of N.S.W.* 87 (5): 24
- Meakins, L. (1976) New mechanical picker a boon to bean growers *Agricultural Gazette of N.S.W.* 87 (4): 16

- Menzies, R., Greenhalgh, W. J. (University of Sydney) and Godley, G. L. (W. A. Department of Agriculture) (1977) Studies of fruit shape in apples: response to gibberellin and cytokinin sprays *Australian Journal of Experimental Agricultural and Animal Husbandry* 17: 505
- Peasley, D. L. (1976) Waxing avocados for better looks and longer life *Agricultural Gazette of N.S.W.* 87 (4): 4
- Peasley, D. L. (1977) The bunchy top story *Banana Bulletin* 41 (4): 2
- Rigney, C. J. (1976) Fumigation of oranges: an export breakthrough *Agricultural Gazette of N.S.W.* 87: 18
- Rippon, L. E. and Fuller, E. J. (1976) New ways of packaging citrus and apples *Agricultural Gazette of N.S.W.* 87 (4): 5
- Rippon, L. E. and Trochoulis, T. (1977) Improved ripening of bananas *Agricultural Gazette of N.S.W.* 88: 26
- Scott, K. J. and Wills, R. B. H. (1976) Improving keeping quality of apples *Agricultural Gazette of N.S.W.* 87: 46
- Scott, K. J., Wills, R. B. H. (University of N.S.W.), Lyford, P. B. (N.Z. Ministry of Agriculture and Fisheries) and Smale, P. E. (N.Z. Ministry of Agriculture and Fisheries) (1976) Prediction of bitter pit with calcium content of apple fruit *N.Z. Journal of Agricultural Research* 19: 513
- Scott, K. J., Wills, R. B. H. (University of N.S.W.) and Franklin, M. (CSIRO) (1976) Abscissic acid and the development of storage breakdown in apples *Phytochemistry* 15: 1817
- Scott, K. J. and Wills, R. B. H. (1977) Vacuum infiltration of calcium chloride: A method for reducing bitter pit and senescence of apples during storage at ambient temperatures *Hort Science* 12: 71
- Scott, K. J. and Wills, R. B. H. (University of N.S.W.) and Hopkirk, G. (N.Z.) (1977) Reduction of soft scald in apples with methyl linolate *Hort Science* 12: 72
- Stevenson, D. R. G. (1976) Ring rot—a new problem *Banana Bulletin* 40 (7): 4
- Stevenson, D. R. G. (1976) Compare misting programmes *Banana Bulletin* 40 (7): 14
- Stevenson, D. R. G. (1976) Farmer of the year, won by a Woolgoolga grower *Banana Bulletin* 40 (8): 8
- Stevenson, D. R. G. (1976) Fertiliser programme should be based on loss of nutrients *Banana Bulletin* 40 (10): 6
- Stevenson, D. R. G. (1976) What are you misting with this year? *Banana Bulletin* 40 (11): 8
- Stevenson, D. R. G. (1977) Production trends in bananas *Banana Bulletin* 41 (1): 2
- Stevenson, D. R. G. (1977) Comparison of costs for cartons between Queensland and Coffs Harbour *Banana Bulletin* 41 (2): 16
- Stevenson, D. R. G. (1977) Reduced mixed ripe by cooling *Banana Bulletin* 41 (4): 4
- Trochoulis, T. and O'Neill, G. H. (1976) Girdling of Fuerte avocado in sub-tropical Australia *Scientia Horticulture* 5: 239
- Valentine, B. J. (1977) Controlled atmosphere storage of pears *Agricultural Gazette of N.S.W.* 88 (1): 34
- Wade, N. L. (1976) Testing fruit for internal defects *Agricultural Gazette of N.S.W.* 87: 24
- Wade, N. L. and Bishop, D. G. (CSIRO) (1977) Lipid composition of sweet cherries *Phytochemistry* 16: 67
- Wild, B. L., Rippon, L. E. and Nichols, P. (1976) Effect of delay between inoculation and SOPP treatment on development of *Geotrichum candidum* in oranges *Plant Disease Reporter* 60: 488
- Worrall, R. J. (1976) Effects of time of collection, growing conditions of mother plants and growth regulators on rooting of cuttings of *Telopea speciosissima* (Proteaceae) *Scientia Horticulture* 5: 153

Post-graduate Theses

- Rigney, C. J. (1976) *Effect of fumigation treatments on fruit physiology and biochemistry* M.Sc. thesis University of New South Wales
- Wild, B. L. (1976) *Long term storage of lemon fruit* M.Sc. thesis University of New South Wales

Contributions to Technical Conferences

- Freeman, B. (1976) Artificial windbreaks and the reduction of windscar in citrus *Proceedings of the Florida State Horticultural Society* 89: 52

Other Publications

- Beattie, B. B. *et al* (1976) Benefit/cost study of Horticultural Research Station, Dareton for the period July 1965 to June, 1975 *New South Wales Department of Agriculture*
- Beattie, B. B. (1977) Economic aspects of the production and marketing of fruit and vegetables in the United Kingdom and Europe *New South Wales Department of Agriculture*
- Bevington, K. B. *et al* (1976) Progress in control of alternate cropping of Valencia oranges *Australian Citrus News* 53: 6
- Blanch, E. C. (1976) Fruit quality—effect of climatic conditions and grove management *Annual Citrus Field Day Booklet*
- Cox, J. E. (1976) Tomato fertilizer trial *C.C.A.R.E.C. Rural Newsletter* 59: 7
- Davey, P. C. (1977) The M.I.A. canning peach industry—Where is it going? *I.R.E.C. Farmers Newsletter* 134: 2
- Davey, P. C. (1977) Winter Yellows could be a problem in young citrus *I.R.E.C. Farmers Newsletter* 134: 14
- Davey, P. C. (1977) Nematodes in M.I.A. grapevines *I.R.E.C. Farmers Newsletter* 135: 2
- Duncan, J. H. (1976) Citrus plantings in the M.I.A. *I.R.E.C. Farmers Newsletter* 132: 3
- Freeman, B. M. (1976) Italian grape varieties *I.R.E.C. Farmers Newsletter* 132: 25
- Hedberg, P. R. (1976) A report on a tour of Italian viticulture and viticultural research *New South Wales Department of Agriculture*
- Hocking, D. F. (1977) New citrus spraying oil *I.R.E.C. Farmers Newsletter* 134: 3
- Hocking, D. F. (1977) The costs and returns for overcoming nematodes *I.R.E.C. Farmers Newsletter* 135: 11
- Hutton, R. *et al* (1976) Mechanical harvesting of canning peaches M.I.A. *I.R.E.C. Farmers Newsletter* 133: 3

- Hutton, R. J. (1976) Adrian harvester looks good on peaches *I.R.E.C. Farmers Newsletter* 130: 26
- McIntosh, C. (1977) Nematode survey in M.I.A. grapevines *I.R.E.C. Farmers Newsletter* 135: 6
- Meakins, L. (1976) Lettuce production on the mountain *C.C.A.R.E.C. Rural Newsletter* 58: 25
- Morris, S. C. (1976) Current vegetable postharvest research *C.C.A.R.E.C. Rural Newsletter* 59: 31
- Murison, J. (1976) Notes on tomato culture *C.C.A.R.E.C. Rural Newsletter* 59: 42
- Murison, J. (1977) Herbicides for tomatoes *C.C.A.R.E.C. Rural Newsletter* 60: 26
- Murison, J. (1977) Tomato trellising *C.C.A.R.E.C. Rural Newsletter* 60: 27
- Murison, J. (1977) A suggested tomato spray programme *C.C.A.R.E.C. Rural Newsletter* 60: 28
- Murison, J. (1977) Searching for money trees (or The golden vegetable crop) *C.C.A.R.E.C. Rural Newsletter* 62: 21
- Murison, J. (1977) Heliothis caterpillars *C.C.A.R.E.C. Rural Newsletter* 62: 29
- Mutton, L. L. (1976) Early rockmelons pay dividends *I.R.E.C. Farmers Newsletter* 130: 2
- Mutton, L. L. (1977) Stop the rot! *I.R.E.C. Farmers Newsletter* 135: 31
- Richens, K. F. (1976) Citrus—give 'em a good start *I.R.E.C. Farmers Newsletter* 132: 8
- Richens, K. F. (1976) Zinc and manganese sprays . . . are they doing any good? *I.R.E.C. Farmers Newsletter* 132: 21
- Richens, K. F. (1977) Where did the water go this summer? *I.R.E.C. Farmers Newsletter* 134: 28
- Rippon, L. E. (1976) Ellendale tangors for export *Australian Citrus News* 52: 4
- Rippon, L. E. (1976) Multiwall kraft paper bags for packaging citrus *Australian Citrus News* 52: 8
- Rippon, L. E. and Fuller, E. J. (1976) Multiwall kraft paper bags for packaging citrus *C.C.A.R.E.C. Rural Newsletter* 59: 21
- Rippon, L. E. (1977) Horticultural postharvest research at the Gosford Laboratory—1976 in retrospect *C.C.A.R.E.C. Rural Newsletter* 60: 14
- Scott, L. A. (1976) Drainage is essential *C.C.A.R.E.C. Rural Newsletter* 58: 9
- Scott, L. A. (1976) Fertilisers for Central Coast citrus *C.C.A.R.E.C. Rural Newsletter* 58: 14
- Scott, L. A. (1976) Seasonal reminders *C.C.A.R.E.C. Rural Newsletter* 58: 31
- Scott, L. A. (1976) Farm planning—who can help? *C.C.A.R.E.C. Rural Newsletter* 58: 35
- Scott, L. A. (1976) Quality spraying aids fruit appearance *C.C.A.R.E.C. Rural Newsletter* 59: 39
- Scott, L. A. (1977) Seasonal reminders *C.C.A.R.E.C. Rural Newsletter* 60: 32
- Scott, L. A. (1977) Grow your own trees *C.C.A.R.E.C. Rural Newsletter* 62: 4
- Scott, L. A. (1977) Citrus geriatrics *C.C.A.R.E.C. Rural Newsletter* 62: 24
- Scott, L. A. (1977) Seasonal reminders *C.C.A.R.E.C. Rural Newsletter* 62: 35
- Slack, J. M. (1977) New fruit crops to be grown at Yanco Research Centre *I.R.E.C. Farmers Newsletter* 135: 35
- Sproule, R. S. (1976) Starting a citrus nursery *I.R.E.C. Farmers Newsletter* 133: 23
- Sproule, R. S. and Richens, K. (1977) Rootstocks for vineyards *I.R.E.C. Farmers Newsletter* 135: 9
- Sumeghy, J. B. (1976) Mechanically harvested processing tomato production and research *Department of Agriculture report of overseas study tour 1976*
- Wild, B. L. (1976) SOPP to control benzimidazole resistant mould *C.C.A.R.E.C. Rural Newsletter* 59: 37

DIVISION OF MARKETING AND ECONOMICS

Department of Agriculture Bulletins and Booklets

- Benson, R. J. and Baker, J. D. (1976) Growing fresh beans *Farm Management Notes* 17 Lismore
- Benson, R. J. and Murison, J. A. (1976) Investment in a Macadamia Nut Orchard *Farm Management Notes* 13 Lismore
- Benson, R. J. and Stevenson, D. R. G. (1976) Establishment costs and profit in bananas *Farm Management Notes* 4 Lismore
- Benson, R. J. (1977) Regional statistics 1974–75 *Farm Management Notes* 18 Lismore
- Catt, C. B. J. (1976) Store weaner production 100 cow: 250 hectare property, Wingham District *Local Consensus Data Report Bulletin M/LCD* 5
- Catt, C. B. J. and Freer, R. E. (1976) Beef herd establishment and production on the N.S.W. Central Coast *Economics Notes* 10
- Gilbert, D. M. (1977) Estate planning issues affecting primary producers *Gosford Rural Development Association Newsletter* Gosford
- Gisz, P. L. and Whitelaw, R. A. (1976) Death taxes and the primary producer *Guide for Graziers* 9: 6 Goulburn
- Gisz, P. L. (1976) 1976–77 Federal Budget: Rural sector *Guide for Graziers* 8: 13 Goulburn
- Gisz, P. L. (1977) Lease or buy? A financing decision *Guide for Graziers* 9: 3 Goulburn
- Gisz, P. L. (1977) Thinking about sharefarming? *Production Topics* 10: 9
- Green, C. W. and Buffier, B. D. (1977) Agricultural and pastoral statistics—summary for New England region *Economic and Technical Bulletin* 15 Tamworth
- Holland, J. F., Buffier, B. D. and Wallens, B. C. (1976) Mung beans in northern N.S.W. *Economic Technical Bulletin* 13 Tamworth
- Kennedy, J. R. (1976) Berriquin farming *Department of Agriculture Economic Information Series* EIS 16
- Knight, M. E., McIntosh, C. E. and Blain, R. G. (1976) Development costs for M.I.A. prunes *N.S.W. Department of Agriculture Economic Information Series* 17

- Logan, R. A. and Kaye, G. R. (1976) Wine grape production 115 hectare: un-irrigated vineyard in the Lower Hunter *Local Consensus Data Report Bulletin M/LCD 4* Maitland N.S.W., Department of Agriculture, Mid Coast and Hunter Region, East Maitland
- Logan, R. A., Forsythe, J. B. and Weale, C. C. (1976) Strawberry production, 10 000 plants: trickle irrigated in the Windsor District *Local Consensus Data Report Bulletin M/LCD 5* N.S.W. Department of Agriculture, Mid Coast and Hunter Region, East Maitland
- Mullen, J. D. and Vere, D. T. R. (1976) Production and value of production statistics—Central Western Agricultural Region 1972/73—1974/75 *Regional Economic Data 9* Orange
- Mullen, J. D. (1976) Crop budgets for Condobolin, Parkes and Cowra Agronomy Districts *Regional Economic Data 10* Orange
- Mullen, J. D. (1977) Financial position of primary producers on the Central Western Slopes and Tablelands in 1976 *Regional Economic Data 11* Orange
- O'Meagher, P. J. D. (1976) A book of verses . . . *Extension Forum 11*: 21
- Vere, D. T. R. and Campbell, M. H. (1977) Investment considerations in the control of serrated tussock (*Nassella Trichotoma*) on the Central Tablelands of New South Wales *Department of Agriculture Technical Bulletin 13*
- Vere, D. T. R. and Campbell, M. H. (1977) An economic appraisal of development plans for the control of serrated tussock on the Central Tablelands of New South Wales *Regional Economic Data 8* Orange
- Whitelaw, R. A. and Gisz, P. L. (1976) Death taxes and the primary producer *Guide for Graziers 6*: 17 Goulburn
- Whitelaw, R. A. and Gisz, P. L. (1976) Death taxes and the primary producer *Guide for Graziers 7*: 9 Goulburn
- Whitelaw, R. A. and Gisz, P. L. (1976) Death taxes and the primary producer *Guide for Graziers 8*: 10 Goulburn
- Whitelaw, R. A. (1976) Farm holidays *Guide for Graziers 8*: 18 Goulburn
- Whitelaw, R. A. (1976) I.A.C. report on dairy marketing *Illawarra Newsletter 7* (10): 7 Goulburn

Contributions to Journals

- Baker, N. R. (1976) Outlook for cereals and oilseeds *Division of Marketing and Economics Commodity Bulletin 5* (1): 19
- Baker, N. R. (1976) Cereals 1976/77 *Division of Marketing and Economics Commodity Bulletin 5* (4): 14
- Baker, N. R. (1977) Overview of the National Agricultural Outlook Conference *Division of Marketing and Economics Commodity Bulletin 5* (7): 1
- Buffier, B. D., Holland, J. S. and Wallens, B. G. (1976) Mung beans *Division of Marketing and Economics Commodity Bulletin 5* (6): 22
- Buggie, G. J. (1977) Allocative ability and farm management: a comment *Review of Marketing and Agricultural Economics 45* (1 and 2): 51
- Davies, B. L. (1976) The economic outlook for papaw production *Division of Marketing and Economics Commodity Bulletin 4* (10): 4
- Davies, B. L. (1976) The outlook for custard apple production *Division of Marketing and Economics Commodity Bulletin 5* (2): 1
- Davies, B. L. and Lahiff, P. A. (1977) Term life assurance—its use for the primary producer *Division of Marketing and Economics Commodity Bulletin 5* (6): 1
- Davies, B. L. (1977) Term insurance O is it cheaper than endowment? *Division of Marketing and Economics Commodity Bulletin 5* (6) 17
- Gilbert, D. M. (1977) Death duties present a problem—but they needn't *The Agricultural Gazette of N.S.W. 88* (2)
- Gisz, P. L. (1976) Federal Budget 1976-77: The Rural Sector *Division of Marketing and Economics Commodity Bulletin 5* (3): 1
- Godden, D. P. and Batterham, E. S. (1977) The economic impact of free lysine on the protein feeds industry in N.S.W. *Review of Marketing and Agricultural Economics 45*: 28
- Graham, M. A. (1976) Aspects of the N.S.W. potato industry *Division of Marketing and Economics Commodity Bulletin 5* (3): 12
- Graham, M. A. (1976) Devaluation implications for N.S.W. rural industries *Division of Marketing and Economics Commodity Bulletin 5* (6): 32
- Graham, M. A. (1977) All risk crop insurance for potatoes *Division of Marketing and Economics Commodity Bulletin 5* (10)
- Hayward, M. A. (1976) Seasonally adjusted statistics *Division of Marketing and Economics Commodity Bulletin 5* (4): 7
- Knight, M. E. (1976) An outline of the New South Wales prune industry *Division of Marketing and Economics Commodity Bulletin 5* (5): 20
- Knight, M. E. (1976) Market outlook for prunes *Division of Marketing and Economics Commodity Bulletin 5* (6): 4
- Logan, R. A., Forsythe, J. B. and Weale, C. C. (1976) Strawberries—are they profitable? *Agricultural Gazette of N.S.W. 87* (6): 14
- Lahiff, P. A. (1976) Sources of marketing and commodity information *Division of Marketing and Economics Commodity Bulletin 5* (2): 6
- Lahiff, P. A. (1976) The market outlook for pigmeats *Division of Marketing and Economics Commodity Bulletin 5* (3): 5
- Lahiff, P. A. and Hillman, L. (1976) Objectives and uses of marketing margins: revised data (July-October, 1976) *Division of Marketing and Economics Commodity Bulletin 5* (6): 1
- Lahiff, P. A. and Richmond, R. N. (1976) Horticultural agent default: the rights of the grower *Division of Marketing and Economics Commodity Bulletin 5* (6): 18
- Lahiff, P. A. and Caruana, M. (1977) Revised meat margins data (November 1976—February, 1977) *Division of Marketing and Economics Commodity Bulletin 5* (9): 7
- Lahiff, P. A. (1977) Unemployment benefits for farmers *Agricultural Gazette of N.S.W. 87* (6): 36
- Martin, J. F. (1976) Changing dimensions of the mutton industry *Division of Marketing and Economics Commodity Bulletin 5* (5): 4

- Martin, J. F. (1976) Mutton: prospects for the future *Division of Marketing and Economics Commodity Bulletin* 5 (6): 1
- McKay, W. A. (1976) A changed income tax system for 1975-76 *Division of Marketing and Economics Commodity Bulletin* 5 (1): 22
- McKay, W. A. (1976) Income Equalisation Deposits (I.E.D.'s) *Division of Marketing and Economics Commodity Bulletin* 5 (4): 19
- McKay, W. A. (1977) Exchange rate control and the value of the Australian dollar *Division of Marketing and Economics Commodity Bulletin* 5 (6): 13
- Mohr, G. M. (1976) Investment in research *Division of Marketing and Economics Commodity Bulletin* 5 (5): 1
- Mohr, G. M. (1977) Exotic feedstuffs: for the laying hen industry *Division of Marketing and Economics Commodity Bulletin* 5 (8): 1
- O'Meagher, P. J. D. (1977) The case study as a farm management tool *Division of Marketing and Economics Commodity Bulletin* 5 (6): 9
- Richmond, R. N. (1977) Outlook and historical price averages for ten major commodities *Division of Marketing and Economics Commodity Bulletin* 5 (9): 8
- Richmond, R. N. (1977) The Australian cotton industry: history and future trends *Division of Marketing and Economics Commodity Bulletin* 5 (10): 1
- Vere, D. T. R. (1976) Analysis of recent fertilizer usage trends in central western N.S.W. *Division of Marketing and Economics Commodity Bulletin* 5 (4): 10
- Whitelaw, R. A. and Simpson, P. C. (1976) The nation benefits from efficient agriculture *Agricultural Gazette of N.S.W.* 87 (5): 4

Contributions to Technical Conferences

- Buffier, B. D. (1976) Economic analysis of meat market *Proceedings Meat Marketing Workshop Orange* p. 28
- Catt, C. B. J. and Fryer, J. G. (1977) Computerised plotting of farm statistics *URPIS FOUR, Proceedings of the fourth Australian Conference on Urban and Regional Planning Information Systems* Melbourne
- Catt, C. B. J. (1977) Problems and benefits of computer mapping *The Globe, Journal and Conference Proceedings of the Australian Map Curators Circle* 7
- Gilbert, D. M. (1977) Co-ordinated Statewide marketing of potatoes—a summary *Proceeding of Potato Symposium '77* Glen Innes
- Mohr, G. M. (1976) Estimating monetary benefits from poultry research *First Australasian Poultry and Stock Feed Convention* Melbourne: 394
- Mohr, G. M. and Robinson, D. (1976) Cage design for laying birds at high stocking densities *First Australasian Poultry and Stock Feed Convention* Melbourne: 269

Books

- Buffier, B. D. and Young, D. S. (1977) Enterprise budgets for north west of N.S.W. *COMPLAN Handbook No. 1* (University of New England, Armidale)
- Kennedy, J. R., Witschi, P. A. and Dann, P. R. (1976) *Report on Two proposed fodder seed farms in the Indian States of Assam and Karnataka* (Australian Development Assistance Agency, Canberra)
- Kennedy, J. R. and Murphy, T. J. (1976) Farm size; Planning enterprise structure; sections III(2) and III(8) in *International Training Course in Irrigation and Drainage* 1 (Australian Development Assistance Agency, Canberra)

Other Publications

- Catt, C. B. J. (1976) It's 3.50 one Friday afternoon *Extension Forum* 10
- Catt, C. B. J. (1976) Learning to live with inflation *Rural Newsletter* 59 (Central Coast Agricultural Research and Extension Committee, Gosford)
- Coomber, B. B. (1977) Assessing the benefits and costs of machinery ownership *I.R.E.C. Farmers' Newsletter* 101
- Coomber, B. B. (1977) The marketing situation and outlook for wine grapes *I.R.E.C. Farmers' Newsletter* 134
- Davies, B. L. (1977) New Scheme Can Save Tax *Macquarie Rural Magazine* 1 (1): 11
- Davies, B. L. and Mullen, C. L. (1977) Gross Margins for linseed, wheat and barley, Dubbo district, 1977 *Macquarie Rural Magazine* 1 (1): 52
- Graham, M. A. (1977) Devaluation implications for N.S.W. rural industries *I.R.E.C. Newsletter* 101: 3
- Kennedy, J. R. (1976) Sorghum and sunflowers for irrigation areas *I.R.E.C. Farmers' Newsletter* 100: 5
- Kennedy, J. R. and Sykes, J. (1976) Summer forage crops *I.R.E.C. Farmers' Newsletter* 100: 24
- Kennedy, J. R. (1976) Servicing loans *I.R.E.C. Farmers' Newsletter* 132: 12
- Kennedy, J. R. (1977) Servicing loans *Western Division Newsletter* 1: 11
- Kennedy, J. R. (1976) Irrigation layout costs *I.R.E.C. Farmers' Newsletter* 99: 25
- Kennedy, J. R. (1976) Costs for Berriquin *I.R.E.C. Farmers' Newsletter* 99: 26
- Kennedy, J. R. (1976) Servicing loans *Rural Enterprise Newsletter* 12: 10
- Knight, M. E. (1976) Prune development costs *I.R.E.C. Farmers' Newsletter* 132: 14
- Knight, M. E. (1976) To apply for re-delivery or buy outright *N.S.W. Department of Agriculture Hard and Soft Wheat Newsletter*
- Knight, M. E. (1976) Economics of lupin growing *Lupin Production N.S.W. Department of Agriculture*: 12
- Logan, R. A. and Hollow, R. (1977) Pig production economics *Local Extension Notes* N.S.W. Department of Agriculture, Mid Coast and Hunter Region, East Maitland
- Logan, R. A. (1977) Tractor operating costs, 50 kw diesel wheeled tractor *Local Extension Leaflet* N.S.W. Department of Agriculture, Mid Coast and Hunter Region, East Maitland
- Logan, R. A. (1976) What is a fair contract price for machinery operations? *Local Extension Leaflet* N.S.W. Department of Agriculture, Mid Coast and Hunter Region, East Maitland
- Logan, R. A. (1976) Tractor operating costs 40 kw diesel wheeled tractor *Local Extension Leaflet* N.S.W. Department of Agriculture, Mid Coast and Hunter Region, East Maitland

- Lahiff, P. A. and Richmond, R. N. (1977) Horticultural agent default: the rights of the grower *Australian Citrus News* **52**: 4
- Lahiff, P. A. (1976) Ways and Means of keeping down costs of machinery. *The Land Newspaper* **3396**: 25

DIVISION OF PLANT INDUSTRY

- Lahiff, P. A. and Richmond, R. N. (1976) Non-paying agents should be reported *Country Life Newspaper* **87** (76): 9
- Lahiff, P. A. (1977) Special youth employment scheme *I.R.E.C. Newsletter Large Area* **10**: 31
- Lahiff, P. A. and Davey, P. C. (1977) Machine aids for citrus harvesting: are they a good alternative? *I.R.E.C. Newsletter Horticultural* **134**: 5
- Lahiff, P. A. and Richmond, R. N. (1977) Horticultural agent default *I.R.E.C. Newsletter Horticultural* **134**: 22
- Martin, J. F. (1977) Export markets key to mutton future *Macquarie Rural Magazine* **1**: 35
- Mohr, G. M. and Sanders, J. (1976) How the egg industry performed in the first 6 months of 1976 *The Poultry Farmer* **44** (16): 8
- Mohr, G. M. (1976) Is research worth it? *The Poultry Farmer* **44** (17): 10
- Mullen, J. D. (1977) Value of commodities produced on the Central Tablelands in 1974/75 *Rural Notes* **14**, Orange
- Mullen, J. D. (1977) Farm profitability—1976 *Rural Notes* **14**, Orange
- Mullen, J. D. (1977) *Cropping strategies—Canowindra 1977/78* Roneo, Orange
- Percival, R. H. (1977) How much tractor power for your farm? *Armidale Liaison Notes* **19**
- Reilly, T. L. C. (1977) Information systems *Meat Marketing Workshop Proceedings* Orange p. 48
- Standen, B. J. (1977) A model of bank rural lending in Australia *Victorian Branch Australian Agricultural Economics Society Monograph* **17**
- Vere, D. T. R. (1976) Partial budgeting and the profitability of enterprise change *Macquarie Rural Newsletter* **4** (2): 8
- Vere, D. T. R. (1976) Importance of superphosphate in the control of pasture weeds on the tablelands *Rural Notes* **9** Orange: 10
- Vere, D. T. R. (1977) Superphosphate Essential for the Permanent Control of Pasture Weeds *Rural Notes* **14** Orange: 4

Department of Agriculture Bulletins and Booklets

- Drummond, G. G., Wright, W. A., Wetherall, R. S. and Ware, B. (1977) Farming with kikuyu *N.S.W. Department of Agriculture Technical Bulletin*

Contributions to Journals

- Archer, K. A. and Swain, F. G. (Hawkesbury Agricultural College) (1977) Evaluation of oat forage for finishing prime lambs on the northern tablelands of N.S.W. *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (86): 385
- Archer, K. A., Barwick, S. A., Kempton, T. J. and Leng, R. A. (University of New England) (1977) A possible problem with proteins *Agricultural Gazette of N.S.W.* **88**: 46
- Auld, B. A. (1976) Grazing of *Bassia birchii* as a method of control. *Tropical Grasslands* **10** (2): 123
- Auld, B. A. (1976) The biology of *Bassia birchii* (F. Muell.) F. Muell. *Weed Research* **16**: 323
- Ballard, J. H. (1976) Registered cereal seed production *Agricultural Gazette of N.S.W.* **87** (5): 36
- Brownlee, H. and Scott, B. J. (1977) Annual medic pastures in N.S.W. *Agricultural Gazette of N.S.W.* **88** (1): 40.
- Campbell, D. A. (1976) Irrigation farming *Agricultural Gazette of N.S.W.* **87** (3): 30
- Campbell, D. A. (1976) Introduced plants *Agricultural Gazette of N.S.W.* **87** (3): 42
- Campbell, M. H. (1976) Effect of timing of glyphosate and 2, 2-DPA application on establishment of surface-sown pastures species *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (81): 491
- Constable, G. A. (1976) Temperature effects on the early field development of cotton *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (83): 905
- Constable, G. A. (1977) Narrow row cotton in the Namoi Valley. 1. Growth, yield and quality of four cultivars *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (84): 135
- Constable, G. A. (1977) Narrow row cotton in the Namoi Valley. 2. Plant population and row spacing *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (84): 143
- Constable, G. A. (1977) Effect of planting date on soybeans in the Namoi Valley, N.S.W. *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (84): 148
- Constable, G. A. and Gleeson, A. C. (1977) Growth and distribution of dry matter in cotton *Australian Journal of Agricultural Research* **28**: 289
- Corbin, E. J., Brockwell, J. (CSIRO) and Gault, R. R. (CSIRO) (1977) Nodulation studies on chickpea (*Cicer arietinum*) *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (84): 126
- Cornish, P. S. with Broue, P. (CSIRO), Mathison, M. V. (S.A. Department of Agriculture) and Kaehne, I. D. (S.A. Department of Agriculture) (1975) Plant Collecting in Central Asia and the Caucasus region of U.S.S.R. *Australian Plant Introduction Review* **10** (4): 11
- Curll, M. L. and Davidson, J. L. (CSIRO) and Freer, M. (CSIRO) (1976) Getting prime lambs to market *Rural Research* **91**: 21
- Curll, M. L. and Davidson, J. L. (CSIRO) (1977) Lamb production: a case study of experimentation and simulation *Agricultural Systems* **2** (2): 121
- Cuthbertson, E. G. (1976) Chemical weed control in lupins *The Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 394
- Cuthbertson, E. G., Leys, A. R. and McMaster, G. S. (1976) Silverleaf nightshade—a potential threat to agriculture *Agricultural Gazette of N.S.W.* **87** (6): 11

- Cutting, F. W. and Bagshaw, F. (1977) What a mixture—sesame, manure and tobacco *Agricultural Gazette of N.S.W.* **88** (1): 39
- Dann, P. R., Axelsen, A. (CSIRO) and Edwards, C. B. H. (CSIRO) (1977) The grain yield of winter-grazed crops *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (86): 452
- Dowling, P. M. and Robinson, G. G. (1976) Some factors affecting the establishment and early production of oversown grasses *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (82): 709
- Dowling, P. M. and Smith, R. C. G. (University of New England) (1976) Use of a soil moisture model and risk analysis to predict the optimum time for the aerial sowing of pastures on the Northern Tablelands of N.S.W. *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (83): 871.
- Doyle, A. D. (1977) Fertilizers for wheat in northern N.S.W. *Agricultural Gazette of N.S.W.* **88** (2): 43
- Drummond, G. G. (1976) Home grown maize boosts SNF *Dairy Topics* **11**: 2
- Felton, W. L. (1976) The influence of row spacing and plant population on the effect of weed competition in soybeans (*Glycine max*) *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (83): 926
- Fitzgerald, R. D. (1976) Better pastures at no extra cost *Agricultural Gazette of N.S.W.* **87** (6): 30
- Garden, D. L. and Cohen, R. D. H. (1977) Superphosphate and legumes go together *Agricultural Gazette of N.S.W.* **88** (1): 47
- Helyar, K. R., Munns, D. N. (University of California) and Burun, R. G. (University of California) (1976) Adsorption of phosphate by gibbsite. I. Effects of neutral chloride salts of calcium, magnesium, sodium and potassium *Journal of Soil Science* **27**: 307
- Helyar, K. R., Munns, D. N. (University of California) and Burun, R. G. (University of California) (1976) Adsorption of phosphate by gibbsite. II. Formation of a surface complex involving divalent cations *Journal of Soil Science* **27**: 315
- Hill, B. D. and Saville, D. G. (1976) Effect of management system and stocking rate on the performance of ewes and lambs *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (83): 810
- Holland, J. F. with Banath, C. L. (University of Queensland) (1976) Iron pyrites as a sulphur fertilizer in an alkaline soil *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (80): 376
- Kemp, D. R. (1976) Observations on the time of sowing and establishment of *Lotononis bainesii* and *Desmodium uncinatum* in the Taree district *Tropical Grasslands* **10** (1): 25
- Kemp, D. R. (1976) The influence of cutting frequency and nitrogen fertilizer on the growth of kikuyu grass *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (80): 382
- Khan, M. A. and Bradshaw, A. D. (University of Liverpool, England) (1976) Adaptation to heterogeneous environments. II. Phenotypic plasticity in response to spacing in *Linum* *Australian Journal of Agricultural Research* **27**: 519
- Khan, M. A., Antonovics, J. (University of Durham, U.S.A.) and Bradshaw, A. D. (University of Liverpool, England) (1976) Adaptation to heterogeneous environments. III. The inheritance of response to spacing in flax and linseed (*Linum usitatissimum*) *Australian Journal of Agricultural Research* **27**: 649
- Kohn, G. D., Osborne, G. J., Batten, G. D., Smith, A. N. and Lill, W. J. (1977) The effect of topdressed superphosphate on changes in nitrogen: carbon: sulphur: phosphorus and pH on a red earth soil during a long term grazing experiment *Australian Journal of Soil Research* **15**: 147
- Komoll, R. F. and Fitzsimmons, R. W. (1977) Cereal variety recommendations for 1977 *Agricultural Gazette of N.S.W.* **87** (6): 5
- Laffan, R. A. and Griffiths, C. N. (1977) Winter legumes or oats and rye for winter feed *Dairy Topics* **13**: 6
- McNamara, D. W. (1976) Wild oat density and the duration of wild oat competition as it influences wheat growth and yield *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (80): 402
- McNeil, A. A. and Osborne, G. J. (1976) You can save labour, time and fuel *Agricultural Gazette of N.S.W.*
- Martin, R. J. (1977) Control of bracken (*Pteridium esculentum*) in pasture with asulam *Weed Research* **17**: 49
- Martin, R. J. and Colman, R. L. (1977) The effects of fertilizers, herbicides, and grazing intensity on the incidence of fireweed (*Senecio latus*) in subtropical pastures *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (85): 296
- Martin, R. J. (1977) Bracken now beaten *Agricultural Gazette of N.S.W.* **88**: 45
- Mears, A. D. (1976) Herbicides—valuable management tool *Agricultural Gazette of N.S.W.* **87** (5): 30
- Michalk, D. L. and Robards, G. E. (1977) Barley grass—weed or feed? *Wool Technology and Sheep Breeding* **24**: 20
- Michalk, D. L. and Beale, J. A. (1976) An evaluation of barrel medic (*Medicago truncatula*) as an introduced pasture legume for marginal cropping areas of south eastern Australia *Journal of Range Management* **29**: 328
- Michalk, D. L., Byrnes, C. C. and Robards, G. E. (1976) Effects of grazing management on natural pastures in a marginal area of south-eastern Australia *Journal of Range Management* **29**: 380
- Michalk, D. L. (1977) Jemalong barrel medic disappoints at Trangie *Agricultural Gazette of N.S.W.* **88**: 47
- Muldoon, D. K. and Pearson, C. J. (University of Sydney) (1977) Hybrid pennisetum in a warm temperate climate—regrowth and stand-over forage production *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (85): 277
- Murtagh, G. J. (1976) Relations between net radiation, global solar radiation and sunshine on the north coast of N.S.W. *Australian Meteorological Magazine* **24** (3): 111
- Peterson, J. R. (1976) Osmotic priming of onion seeds—the possibility of a commercial scale treatment *Scientia horticultrae* **5**: 207

- Robinson, G. G. (1976) Productivity and response to the nitrogen fertilizer of the native grass *Danthonia racemosa* (Wallaby grass) *The Australian Rangeland Journal* **1** (1): 49
- Robinson, G. G. and Dowling, P. M. (1976) Management of natural pastures on the northern tablelands of N.S.W.—a survey *The Australian Rangeland Journal* **1** (1): 70
- Rose, I. (1977) Dodds—a new soybean variety for N.S.W. *Agricultural Gazette of N.S.W.* **88** (1): 32
- Scott, B. J. and Brownlee, H. (1976) Assessments of annual legumes for pastures *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (82): 739
- Spurrs, A. B. (1977) A guide to efficient seed buying *Agricultural Gazette of N.S.W.* **88** (1): 36
- Spurway, R. A., Hedges, D. A. (CSIRO) and Wheeler, J. L. (CSIRO) (1976) The quality and quantity of forage oats sown at intervals during autumn: effects of nitrogen and supplementary irrigation *Australian Journal of Experimental Agriculture and Animal Husbandry* **16** (81): 555
- Strang, J. and Campbell, D. A. (1976) Weeds and their control *Agricultural Gazette of N.S.W.* **87** (3): 44
- Thompson, J. A. (1977) Effect of irrigation termination on yield of soybeans in southern N.S.W. *Australian Journal of Experimental Agriculture and Animal Husbandry* **17** (84): 156
- Thompson, J. A., Sheridan, K. P. and Hamilton, B. A. (1976) The effects of rates of stocking with rotational grazing on the productivity of dryland lucerne at Tamworth, New South Wales *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 845
- Wilson, G. P. M. and Hennessy, D. W. (1977) The germination of excreted kikuyu grass seed in cattle dung pats *Journal of Agricultural Science Cambridge* **88**: 247
- Woodward, R. G. (1976) Photosynthesis and expansion of leaves of soybean grown in two environments *Photosynthetica* **10**: 274
- Woodward, R. G. and Begg, J. E. (CSIRO) (1976) The effect of atmospheric humidity on the yield and quality of soybean *Australian Journal of Agricultural Research* **27** (4): 501
- Woodward, R. G. (1976) Some physiological and environmental factors limiting the yield of soybean *Journal of the Australian Institute of Agricultural Science* **42**: 105
- Woodward, R. G. with Rawson, H. M. (CSIRO) and Begg, J. E. (CSIRO) (1977) The effect of atmospheric humidity on photosynthesis, transpiration and water use efficiency of leaves of several plant species *Planta* **134**: 5

Contributions to Technical Conferences

- Armstrong, E. L. (1976) Alternative crops to wheat in the Macquarie Valley of N.S.W. *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–4
- Auld, B. A. with Menz, K. M. (University of Queensland) (1977) Galvanized burr, control and public policy *21st Annual Conference Australian Agricultural Economic Society* Brisbane 18
- Campbell, M. H. (1976) Pasture establishment on unploughed hill land in N.S.W. *International Hill Land Symposium* Morgantown, West Virginia, U.S.A.
- Campbell, M. H. and Kehghi, A. (1976) Use of aerial techniques for pasture improvement in the hill lands of Iran *International Hill Land Symposium*, Morgantown, West Virginia, U.S.A.
- Chase, D. L. (1976) Effect of plant arrangement and leaf type on the yield of irrigated soybeans in southern N.S.W. *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–51
- Colless, J. M. (1977) Race differentiation of *Drechslera turcica* causing leaf blight of maize in northern N.S.W. *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra **4** (b)–15
- Constable, G. A. (1976) The effect of planting date on soybeans in the Namoi Valley, N.S.W. *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (a) ii–11
- Constable, G. A. and Hearn, A. B. (1977) Physiological and agronomic responses of soybean and sorghum crops to irrigation I. Growth, development and yield *Australian Society of Plant Physiologists* Brisbane
- Corbin, E. J. (1976) Adaptation of chickpeas to the Australian environment *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (a) ii–16
- Corbin, E. J. (1976) Rapeseed in the southern N.S.W. farming system *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–20
- Corbin, E. J. (1976) Chickpea agronomy in the N.S.W. wheat belt *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–85
- Corbin, E. J. (1976) Optimum flowering dates for lupins in southern N.S.W. *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–77
- Curl, M. L. (1976) Topdressing strategies for perennial pastures in the higher rainfall area of the Riverina *Proceedings Riverina Outlook Conference* 4–76
- Cuthbertson, E. G. (1976) The response of lupins to post-emergence application of carbetamide *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (c)–15
- Dann, P. R. (1976) Effect of sowing time on rapeseed yields on the southern tablelands of N.S.W. *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (b)–26
- Felton, W. L. (1976) Development of satisfactory weed control in soybeans *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **4** (c)–3
- Fisher, J. and Syme, J. R. (1977) Stimulation of irrigated wheat production in southern N.S.W. with a high yielding cultivar, Egret *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra **3** (a)–144
- Fletcher, R. J., Single, W. V. and Marcellos, H. (1977) Breeding wheat for resistance to spring frost *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra **3** (b)–12
- Green, K. R. (1977) The history, distribution and control of water hyacinth in Australia *Water Research Foundation of Australia Symposium* (The menace of water hyacinth and other aquatic weeds) Adelaide p. 56
- Hodgson, A. S. (1976) Responses of four cultivars of rapeseed to photoperiod and vernalisation *Australian Oilseeds and Protein Grains Research Conference Toowoomba* **2** (a) ii–7
- Holland, J. F. and Felton, W. L. (1976) Intercropping soybeans, maize and grain sorghum *Australian Oilseeds and Protein Grain Research Conference Toowoomba* **2** (b)–66

- Hughes, R. M. (1976) Cropping of *Lupinus* species on hill lands in subtropical areas on the east coast of Australia *Proceedings of the International Hill Land Symposium* Morgantown, West Virginia, U.S.A.
- Hughes, R. M. and O'Neill, G. H. (1977) Measurement and analysis of germination data *Australian Seeds Research Conference* Tamworth 2 (b)-1
- Knights, E. J. (1976) Chickpea in the central west of N.S.W. *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (b)-33
- Knights, E. J. (1976) Chickpea—a new grain legume for Australia's drier wheatbelt *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra 8-14
- Lewin, L. G. and Sparrow, D. H. (University of Adelaide) (1977) Response of barley genotypes to drought at specific ontogenetic stages *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra 3 (b) 1-5
- Lewin, L. G., Sparrow, D. H. (University of Adelaide) and Aspinall, D. (University of Adelaide) (1977) Proline accumulation and drought resistance in barley *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra 3 (b) 8-12
- Leys, A. R. and Hill, B. D. (1976) Weed Control in oilseed rape *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 4 (c)-2
- Leys, A. R. and Cuthbertson, E. G. (1977) *Solanum elaeagnifolium* cav. (Silverleaf nightshade) in Australia *30th Annual Meeting of the Southern Weed Science Society of America* Dallas, Texas, U.S.A.
- Martin, R. J. and Quirk, R. D. (1976) Weed control in soybeans on the North Coast of N.S.W. *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 4 (c)-5
- Mears, A. D. (1976) Agricultural and pastoral problems *Proceedings of Symposium of Royal Society of Queensland* (The border ranges—a land use conflict in regional perspective), Binna Burra
- Michalk, D. L. and Herbert, P. K. (1976) The effects of grazing on the stability of *Chloris* pastures in central western N.S.W. *Arid Zone Research Conference* Kalgoorlie
- Peterson, J. R. (1977) Seed quality and longevity with particular reference to woody species *Australian Seeds Research Conference* Tamworth 3 (a)-1
- Read, B. J. with Oram, R. N. (CSIRO) (1976) Breeding narrow-leaved lupins for southern N.S.W. *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (b)-32
- Rose, I. A. with McWhirter, K. S. (Sydney University) (1977) A comprehensive breeding plan for soybean improvement *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra
- Rose, I. A. with McWhirter, K. S. (Sydney University) (1976) Population improvement by selection of superior founder populations in soybean breeding *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (b)-8
- Rose, I. A. and McWhirter, K. S. (Sydney University) (1976) Germplasm sharing and controlled introgression in soybean breeding *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (b)-11
- Scott, G. R. (1976) Effects of plant density and variety on performance of dryland sunflowers *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 2 (b)-11
- Shaw, A. J. and Banks, L. W. (1976) Soybean research in the Macquarie Valley N.S.W. *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 2 (b)3-7
- Symes, K. J. (1977) Gene banks and working collections *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra 1 (a)-28
- Symes, K. J. (1977) Senescence and storage *Australian Seeds Research Conference* Tamworth 3 (b)-1
- Thompson, J. A. (1976) Determination of physiological maturity of sunflowers *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 2 (a) i-13
- Wolfe, E. C., Curll, M. L., Fitzgerald, R. D., Hall, D. G. and Southwood, O. R. (1976) Changing livestock production in the cereal zone of southern N.S.W. *Proceedings Australian Institute of Agricultural Science* 1: 209
- Woodward, R. G. with McDonald, D. J. (1977) Control of plant size for maximum efficiency of rice production in temperate areas *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra 1: 3 (a)-17
- Wratten, N. (1976) Breeding for oil and meal quality in rape *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (a)-30
- Wratten, N. (1976) Breeding for blackleg resistance in rape *Australian Oilseeds and Protein Grains Research Conference* Toowoomba 3 (a)-34
- Wratten, N. (1977) Breeding for resistance to blackleg (*Leptosphaeria maculans* (Desm.) Cas. et de Not) in rape (*Brassica campestris* L. and *Brassica napus* L.) *3rd International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO)* Canberra
- Fitzgerald, R. D. (1976) Pasture management and grazing practice *Proceedings Riverina Outlook Conference* 2-1

Post Graduate Theses

- Curll, M. L. (1977) *Relationship between lamb production and seasonal production of pastures* M.Rur.Sc. Thesis, University of New England
- Fletcher, R. J. (1976) *Physiological and genetic studies of wheat characters associated with frost resistance* Ph.D. Thesis, University of Sydney
- Michalk, D. L. (1977) *Grazing management of dryland lucerne in the Macquarie region of N.S.W.* M.Sc. Thesis, University of N.S.W.
- Morgan, J. M. (1976) *A simulation model of the growth of the wheat plant* Ph.D. thesis, Macquarie University
- Read, J. W. (1977) *Some factors affecting production of two species and two interspecific hybrids of phalaris under irrigation* M.Rur.Sc. Thesis, University of New England
- Rose, I. A. (1976) *Choice of founder populations for improvement of soybean (Glycine max L. Merrill) by resolution of quantitative genetic variability* Ph.D. Thesis, University of Sydney

Other Publications

- Campbell, M. H. (1976) New herbicides for the control of serrated tussock *Australian Weeds Research Newsletter* 23: 38
- Chase, D. L. (1976) Soybeans—a summer crop worth considering *I.R.E.C. Farmers Newsletter* 100: 27
- Constable, G. A. (1976) Cotton plant population *Cotton Newsletter* 20
- Dear, B. S. with Zorin, M. (CSIRO) and Hely, F. W. (CSIRO) (1976) Young plant vigour and nodulation studies in diploid forms of *Trifolium ambiguum* Bieb. *Field Station Record* 15 (2)
- Dear, B. S. with Zorin, M. (CSIRO) and Hely, F. W. (CSIRO) (1976) Host strain relationships in symbiosis between heraploid *Trifolium ambiguum* Bieb. (Caucasian clover) and strains of *Rhizobium trifolii* *Field Station Record* 15 (2)
- Khan, M. A. and Batten, G. D. (1976) A possible method for the selection of high protein segregant lines in a wheat breeding programme *Australian Field Crop Newsletter* 11: 14
- Khan, M. A. with Batten, G. D. (1976) The cost of P drain *Australian Field Crop Newsletter* 11: 15
- Khan, M. A. (1976) Effects of low doses of ionizing radiation and storage of irradiated seeds on wheat varieties *Australian Field Crop Newsletter* 11: 20
- Khan, M. A. with Lester, D. A. (CAE, Wagga) (1976) Sprouting resistance in southern wheats *Australian Field Crop Newsletter* 11: 22
- Khan, M. A. and Morrison, P. G. (1976) Variability of grain hardness in wheat *Australian Field Crop Newsletter* 11: 23
- Knights, E. J. (1976) Chickpea breeding in New South Wales *Australasian Plant Breeding and Genetics Newsletter* 26: 104
- Lewin, L. G. (1977) Rice research teams achievements outlined *Ricemill News* 11 (8): 10
- Martin, R. H., Kuiper, J., Murray, G. M. and May, C. E. (1976) Septoria Leaf Blotch—a major wheat disease *Bulk Wheat* 10: 49
- Martin, R. H. (1976) *Septoria tritici* in southern N.S.W. *Australasian Plant Breeding and Genetics Newsletter* 26: 69
- Mears, A. D. (1976) *Solanum karsensis* and *S. elaeagnifolium*—a comparison *Solanaceae Newsletter* 3: 12
- Medd, R. W. and Murray, G. M. (1976) Detection of a possible seed-borne disease in introduced *Bromus* spp. *Australian Seed Science Newsletter* 2: 67
- Peterson, J. R. (1976) Seed moisture and imbibition temperature as factors in bean seed germination *Australian Seed Science Newsletter* 2: 62
- Spurway, R. A., Turner, N. C. (CSIRO) and Slatyer, R. O. (Australian National University) (1976) The influence of rooting patterns on the water relations of plants in mixed communities *Arid Zone Newsletter* p. 10
- Robinson, G. G. (1976) Recording of point quadrat data *Range Management Newsletter* 76 (4): 8
- Thompson, J. A. (1976) Water use efficiency *Sorghum Newsletter* 19: 3
- Thompson, J. A. (1976) Irrigation management of sunflower *I.R.E.C. Farmers Newsletter* 100: 19
- Thompson, J. A. (1976) Soybeans need and respond to water *I.R.E.C. Farmers Newsletter* 100: 30
- Thompson, J. A. (1977) Irrigating sunflowers—stop when they drop *I.R.E.C. Farmers Newsletter* 101: 5
- Thompson, J. A. (1977) Grain filling of Egret wheat *I.R.E.C. Farmers Newsletter* 102: 14
- Woodward, R. G. (1976) A summary of rice research during 1975–76 *Ricemill News* 11: 16
- Woodward, R. G. and McDonald, D. J. (1976) Current research in rice agronomy *I.R.E.C. Farmers Newsletter* 99: 17
- Woodward, R. G., Blakeney, A. B. and McDonald, D. J. (1976) Selecting a new long grain variety of rice *I.R.E.C. Farmers Newsletter* 99: 20
- Woodward, R. G. (1977) Developing rice varieties better adapted to our temperate climate *I.R.E.C. Farmers Newsletter* 101: 23

DIVISION OF RESEARCH SERVICES**Department of Agriculture Bulletins and Booklets**

- Smith, A. N. and Batten, G. D. (1977) The efficiency, accuracy and reliability of soil testing for phosphorus in wheat: a study in the southern wheatbelt *Technical Bulletin* 11

Contributions to Journals

- Hill, B. D. and Saville, D. G. (1976) Effect of management system and stocking rate on the performance of ewes and lambs *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 810
- Saville, D. G. and Herdegen, J. W. (1976) Trangie Agricultural Research Station and the Macquarie merino field days *Agricultural Gazette of N.S.W.* 87 (6): 9
- Single, W. V. with Banath, C. L. (University of Queensland) (1976) Frost injury to wheat stems and grain production *Australian Journal of Agricultural Research* 27: 749
- Southwood, O. R., Saville, D. G. and Gilmour, A. R. (1976) The value of merino ewes to continued superphosphate top dressing on a subterranean clover pasture ley *Australian Journal of Experimental Agriculture and Animal Husbandry* 16: 197
- Worrall, V. S. and Roughley, R. J. (1976) The effect of moisture stress on infection of *Trifolium subterraneum* L. by *Rhizobium trifolii* Dang. *Journal of Experimental Botany* 27: 1233

Contributions to Technical Conferences

- McDonald, D. J. (1976) Rice production in Australia with special reference to rotations and soil fertility *Seminar on high yielding varieties of paddy rice Association for Science Co-operation in Asia*, Tokyo, Japan 19

- McDonald, D. J. (1976) Rice production in Australia—current status of high yielding rice *Seminar on high yielding varieties of paddy rice, Association for Science Co-operation in Asia, Tokyo Japan*
- McMahon, P. J., Robinson, D. and Armstrong, J. P. (1976) Egg shell meal as a calcium source for laying hens *Proceedings of the First Australasian Poultry Stock Feed Convention* p. 372
- Other Publications**
- Brown, G. A. and Hutton, R. J. (1976) The Glenfield cherry trailer *Agricultural Engineering Centre Technical Report* 76/1
- Davis, C. H., Saville, D. G. and McInnes, P. (1976) Production feeding of weaner lambs with diets based on wheat—effects of diets and management *Australian Society of Animal Production* 11: 433
- McDonald, D. J. (1976) Rice research in 1975 *Ricemill News* 11 (4): 22
- McDonald, D. J. (1976) High seed and nitrogen rates—a bad combination for Inga *I.R.E.C. Farmers Newsletter* 99: 2
- Woodward, R. G., Hartley, R. A. and McDonald, D. J. (1976) The pure seed scheme for rice *I.R.E.C. Farmers Newsletter* 99: 22

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

Contributions to Journals

- Blaxell, D. F. (1976) *Angophora hispida*, a new name for *A. cordifolia* (Myrtaceae) *Kew Bulletin* 31: 272
- Briggs, B. G. and Ehrendorfer (University of Vienna) (1976) *Chionohebe*, a new name for *Pygmea* Hook. f. (Scrophulariaceae) *Contributions from Herbarium Australiense* 25: 1
- Briggs, B. G. (1977) Research on *Plantago* *Australian Plants* 9: 84
- Briggs, B. G., Carolin, R. C. (Sydney University) and Pulley, J. M. (Canberra Botanic Gardens) (1977) Plantaginaceae *Flora of New South Wales* 181: 1
- Johnson, L. A. S. with Carolin, R. C. (Sydney University) (1976) Obituary: Obed David Evans *Telopea* 1: 87
- Johnson, L. A. S. (1976) Problems of species and genera in *Eucalyptus* (Myrtaceae) *Plant Systematics and Evolution* 125: 155
- Johnson, L. A. S. (1977) A rich and unfamiliar Flora *Australian Natural History* 19: 58
- Lander, N. S. (1976) *Actites*, a new genus of Compositae from Australia *Telopea* 1: 129
- May, V. (1976) Changing dominadce of an algal species (*Caulerpa filiformis* (Suhr.) Hering) *Telopea* 1: 106
- Pickard, J. with Cunningham, G. M. and Milthorpe, P. L. (Soil Conservation Service N.S.W.) of (1976) Plant communities 'of the Western Lands Division' *Agricultural Gazette of N.S.W.* 87: 16
- Pickard, J. (1976) Contamination of rumen samples during washing *Journal of Range Management* 29: 438
- Pickard, J. with Hutchings, P. A., Recher, H. F. and Weate, P. B. (Australian Museum) (1977) A survey of mangroves at Brooklyn, Hawkesbury River, N.S.W. *Operculum* 5: 105
- Tindale, M. D. with Kramer, K. U. (University of Zurich) (1976) The Lindsaeoid ferns of the Old World VII. Australia and New Zealand *Telopea* 1: 91
- Thompson, J. (1976) A revision of the genus *Tetratheca* (Tremandraceae) *Telopea* 1: 139

Contributions to Technical Conferences

- Pickard, J. (1977) The use of fire in the management of small reserves. Proceedings of a symposium conducted at the Australian Museum *Ecofire* p. 7

ANNEXE

REPORT OF THE PRICKLY PEAR DESTRUCTION COMMISSION FOR THE YEAR ENDED 1976-77

The Hon. D. Day, M.L.A.,
Minister for Primary Industries.
Sir,

I submit the report of the Prickly-pear Destruction Commission for the year ended 30th June, 1977.

Mechanical and biological measures to control and eradicate prickly-pear were continued throughout all infested areas of the State during the year and the provisions of the Prickly-pear Act, 1924, were enforced. Co-operation and good relationships were maintained with land owners, government departments and instrumentalities, both Commonwealth and State.

The Commission assists all owners of prickly-pear infested properties by supplying them with prickly-pear spray and spraying equipment at greatly reduced prices. Many owners of heavily infested lands were given assistance in the form of free prickly-pear destruction work or free supplies of prickly-pear spray. In addition, assistance was given to government departments, both State and Commonwealth, shire councils, pastures protection boards, trustees of commons, cemeteries, parks and reserves, to destroy prickly-pear on lands under their control. The cost of free work and free prickly-pear spray, supplied to landholders, government departments and instrumentalities, amounted to \$136,329.09.

The destruction of prickly-pear on all unoccupied Crown lands is the responsibility of the Commission. The work was continued throughout the year and the cost to maintain these areas free from prickly-pear was \$28,245.44.

Prickly-pear eradication work, which cost \$121,788.00, was carried out under contract by the Commission for two hundred and twenty-four (224) private land-owners. Some owners were assisted, regarding payment for the work, by allowing them to pay by instalments over a period of years at a low interest rate.

The depressed state of the rural industry is still creating problems with control of prickly-pear. It has been difficult to keep prickly-pear down to an acceptable level in some districts because many landholders are in financial difficulties. They cannot afford the high cost for eradication measures. Chemical control measures are costly whereas biological control is comparatively inexpensive. Biological control is being used wherever possible to avoid the high cost of spraying operations. Supplies of prickly-pear insects, cactoblastis and cochineal, are made available to landholders free of cost and liberated on their properties as required.

The eradication of Tiger Pear is the main problem confronting the Commission. This variety of prickly-pear is difficult and costly to eradicate, particularly in localities where cochineal insects, which are used to control Tiger Pear, are ineffective due to adverse climatic conditions. In these areas expensive spraying operations are necessary.

During the year forty-five (45) owners failed to take satisfactory action to destroy prickly-pear on their properties. These landholders were given notices, under the provisions of the Prickly-pear Act, to destroy the prickly-pear. Thirty (30) owners have complied with the notices. Action is still in progress regarding fifteen (15) properties.

The total expenditure by the Commission for the year ended 30th June, 1977, was \$968,406.11. An increase of \$89,199.61 compared to last year.

Sundry debt was decreased by \$89,199.61 during the year. The amount outstanding is \$34,138.64 compared to \$36,185.00 last year.

There were fifty-one (51) Prickly-pear Leases covering an area of 23 631 hectares at 30th June, 1977, of which thirty-three (33) comprising 15 904 hectares were leases in perpetuity.

The Prickly-pear Destruction Commission has a staff of four (4) administrative officers and sixty (60) men on field duties. They comprise nine (9) Public Service Board appointees and fifty-five (55) employed under the Prickly-pear Act.

A statement of income and expenditure of the Prickly-pear Destruction Commission for the year ended 30th June, 1977, follows.

V. H. GRAY,
Commissioner.
26th July, 1977.

PRICKLY-PEAR DESTRUCTION FUND

Statement of Income and Expenditure—Year Ending 30th June, 1977

<i>Credit</i>	\$	<i>Debit</i>	\$
Balance in Funds as at 30th June, 1977 ..	7,024.03	Salaries, Wages, Allowances, Workers Compensation and Payroll Tax ..	691,329.48
Special Appropriation	60,000.00	Travelling Allowances and Expenses ..	38,381.71
Supplementation from Consolidated Revenue	830,000.00	Purchase and Maintenance of Motor Vehicles	134,308.03
Collections (Sale of Poisons and Goods, Destruction of Pear Recoverable, Search Fees and Proceeds from Sale of Motor Vehicles)	118,917.76	Stock, Plant and Minor Equipment ..	84,228.26
		Minor Expenses (Insurance, Freight and Cartage, Buildings and Improvements) ..	9,394.43
		Rents and Rates	6,880.55
		Postal and Telephone Charges	3,883.65
			968,406.11
		Balance Unpending 30th June, 1977 ..	47,535.68
	<u>\$1,015,941.79</u>		<u>\$1,015,941.79</u>



Department of Agriculture
New South Wales